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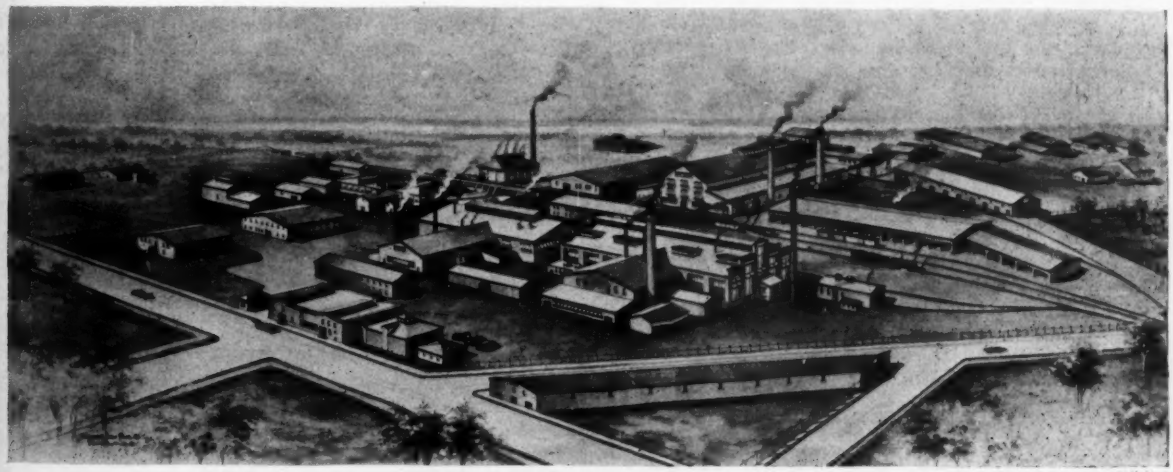
One Hundred and Twelve Years of Glassmaking

A South Jersey Industry Started While the Republic Was Young, Still in Operation on Its Original Factory Site

The State of New Jersey has at all times been famous for one thing or another—in modern times for her beaches and peaches and somewhere in the dim past for her apple-jack and certain other delicacies. But it seems probable that the earliest product to bring distinction to her industrial reputation was glass. It is interesting to note that on the identical site where the first small, crudely equipped glass factory was located (one of the earliest to be built on the continent) glassmaking operations have been steadily carried on, and today are conducted at the same place on a large scale, employing the latest inventions in automatic machinery and approved modern glassmaking methods.

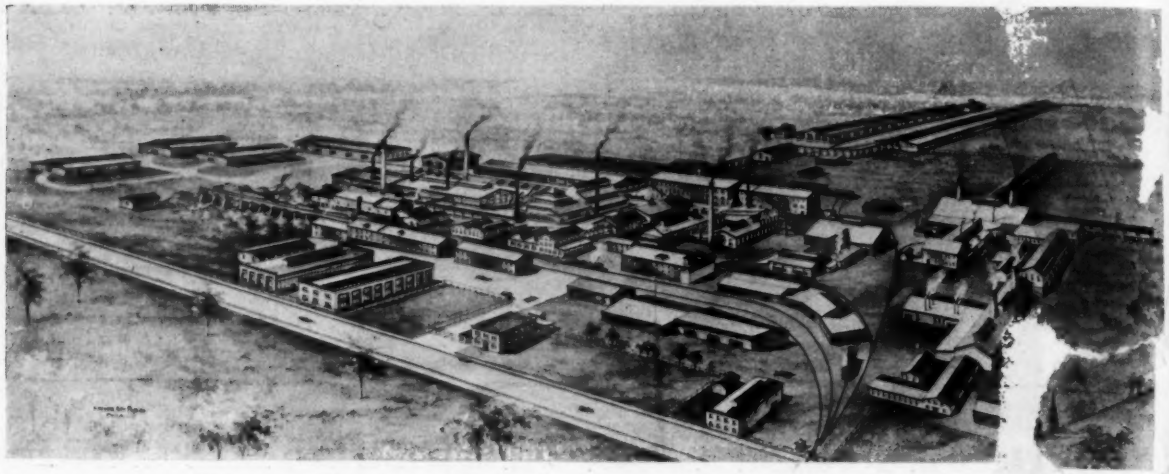
The founding of the new industry in southern New Jersey, with its plentiful supply of good silica sand, furnace and pot clay, an unlimited supply of cord wood for fuel in melting and annealing furnaces, its extensive lumber forests of pine and oak, its central location, navigable rivers and convenient shipping facilities, resulted eventually in the State becoming the center of a great industry, a position held for many years, until the discovery of the cheap fuel—natural gas—and the westward trend of population drew much of the glass manufacturing trade away to the Middle West.

The story of the initial venture into glassmaking in a new country and its subsequent developments have been briefly and interestingly outlined in a little book published some time ago by the Municipal League of Millville, New Jersey, in which the author writes:



UPPER WORKS, WHITALL TATUM COMPANY AT "GLASSTOWN," MILLVILLE, NEW JERSEY

> "Back in 1814, Gideon Scull, realizing the possibilities, built the first glass furnace for the making of window glass, on the east bank of the river, at the present location of Whitall Tatum Company's upper works. This district was known as "Glasstown" and is referred to by that name to this day. In 1818, the plant was converted into a bottle factory. The business was sold in 1835 to Scattergood, Haverstick & Company who operated it successfully until 1845 when it was purchased by two brothers, John Mickle Whitall [a sea captain, who tried his hand at glassmaking] and Israel Franklin Whitall, the former being the grandfather of John M. Whitall, the present [1915]



LOWER WORKS, WHITALL TATUM COMPANY, SOUTH MILLVILLE, NEW JERSEY

treasurer of Whitall Tatum Company. In 1857, Edward Tatum became a member of the firm, the title being Whitall Tatum & Company. The firm retained this name until 1901 when it was incorporated under the name of Whitall Tatumn Company.

"In 1832 two Germans by the name of Frederick and Philip Schetter built two furnaces in South Millville for the manufacturing of window glass and that section of the town was known as Schetterville. In 1844 the plant was sold to Lewis Mulford, who also founded the Millville National Bank. It was operated by Mr. Mulford until 1854 when it was sold to Whitall Brothers who converted it into a hollow-ware factory for the manufacturing of flint glasware and is today the mammoth plant of Whitall Tatum Company known as the South Millville Works.

"The successful development of this business is largely due to the excellent quality of the ware produced and the energetic men who have acted as executive heads of the plants during their growth, a list of which, in the order of their incumbency follows: William Scattergood, I. T. Whitall, Edward Tatum, Henry Lawrence, Robert P. Smith, John Mickle, Bond V. Thomas and George S. Bacon. The last named has been general manager of both works since 1897. Mr. Bacon's extensive knowledge of the glass business has given him a nation-wide reputation in the trade."

Control of the company has been maintained by four generations of the Whitalls and three of the Tatums. The personnel at present is as follows: F. C. Tatum, New York, president; J. W. Nicholson, Morristown, New Jersey, vice-president; George F. Bacon, Millville, New Jersey, vice-president and general manager; W. H. B. Whitall, Philadelphia, treasurer; H. V. Brumley, New York, secretary; J. Lawrence Bacon, assistant superintendent at the lower works, and J. S. Horton, assistant superintendent at the upper works.

Dr. George S. Bacon has been connected with the firm for forty-five years. He is a prominent member of various scientific and industrial organizations devoted to glass and an occasional contributor to the technical literature of the industry.

Striking evidence of the long-standing stability of the institution here described, Whitall Tatum Company, and of the success of its policies towards its employes is given below in a list of its workers who up to Septem[illegible] 1916, had remained in the company's service for period[illegible] of 44 years or longer. At that time there were thirty-two[illegible] with service records ranging from 44 to 64 years of service.

Compiled ten years ago, at the same time the accompanying photograph was taken, the list when re-checked recently showed that only eight of the thirty-two veterans have died during the ten-year period, eleven had retired from active duty and thirteen are still at work. The present record-holder for long service, Joseph Dilks, born 1846, entered the Company's employ in 1858, and has served through a period of 68 years up to 1926.

Employes with Service Records of 44 Years or More

Reading from left to right the men in the group on the opposite page are:

	Year Born	Entered Employ	Years of Service Up to 1916
Back Row			
†Geo. S. Dawson	1856	1871	45
Joseph V. Hand	1857	1870	46
David Campbell	1853	1861	55
*Arthur Berry	1853	1863	53
†Jacob Berry	1846	1863	53
*David Lutes	1844	1857	59
Lewis Waltman	1856	1866	50
†John Welch	1851	1851	55
*Henry Waltman	1859	1857	49
William Beakley	1859	1859	47
†Lewis R. Corson	1849	1872	44
Middle Row			
John Shrider	1854	1863	53
John Stanger	1860	1870	46
Frank Getsinger	1863	1871	45
*Jacob Recap	1840	1863	53
†Grion Vanaman	1857	1871	45
*Thomas Cossaboom	1850	1859	57
*Daniel Gifford	1843	1852	64
George S. Austin	1856	1869	47
Samuel Berry	1859	1869	47
†John H. Ottinger	1857	1870	46
Front Row			
Harry Reeves	1854	1869	47
Charles Cramer	1857	1867	49
Thomas Estell	1852	1865	51
†Alonzo Cossaboom	1853	1862	54
†Samuel Craig	1858	1869	47
Joseph Dilks	1846	1858	58

*Andrew Bennett	1858	1871	45
†John Sharp	1845	1855	61
†Andrew Anderson	1851	1864	52
†Jerry Corson	1849	1860	56
*Thomas Bareford	1859	1872	44

* Since deceased. † Now retired. All others still in employ of company, August, 1926.

The Company's Works and Products

The principal products of the works are prescription and proprietary bottles in a large variety, pharmaceutical articles, acid bottles, vials, milk bottles, packers' ware, demijohns, 5 and 12 gallon carboys, battery jars and insulators. The total annual production is something over a million gross of bottles.

Distributing branches are maintained in New York, Philadelphia, Boston, Chicago, San Francisco, Sydney, N. S. W., and Buenos Aires. Before the war the company did considerable exporting but since then this department has not been very active, although at the present time exports of glass to South American countries are increasing.

Prior to the introduction of mechanical processes of glass blowing all the glass was melted in pot furnaces and blown "by hand." About 2500 workers were employed. Keeping abreast of the times, however, modern equipment was installed and production is now by automatic machinery. Only about half as many workers as formerly employed are required while production capacity of course is much enlarged.

The company, as mentioned above, operates two large plants in Millville known respectively as the upper and lower works. At the upper works where there are two continuous melting tanks, light green and amber products are made, while at the lower works two tanks are alloted to flint glass.

The upper plant covers 15 acres of land. At the lower works there are 25 acres enclosed and a big adjoining tract ready for development when needed.

At the latter plant the two continuous tanks each provide flint glass for four Lynch blowing machines fed by Hartford-Empire feeders of the plunger type. For annealing the ware made on these machines there is available a Hartford automatic lehr recently installed and 10 ten-foot Steelman lehrs.

At the same works there is also a building containing a special department for stopper grinding, the lamp room, cutting, smoothing and engraving department, and the graduating department, in which graduated ware is produced according to the United States Bureau of Standards and State government standards. Every graduated article sent out is stamped with a guarantee of accuracy. At the time the official standards were being established the Whitall-Tatum Company's co-operation was requested and given to the Bureau.

The batch mixing and conveying systems at both plants were designed by the Link-Belt Engineering Company. T. L. Smith mixers are used.

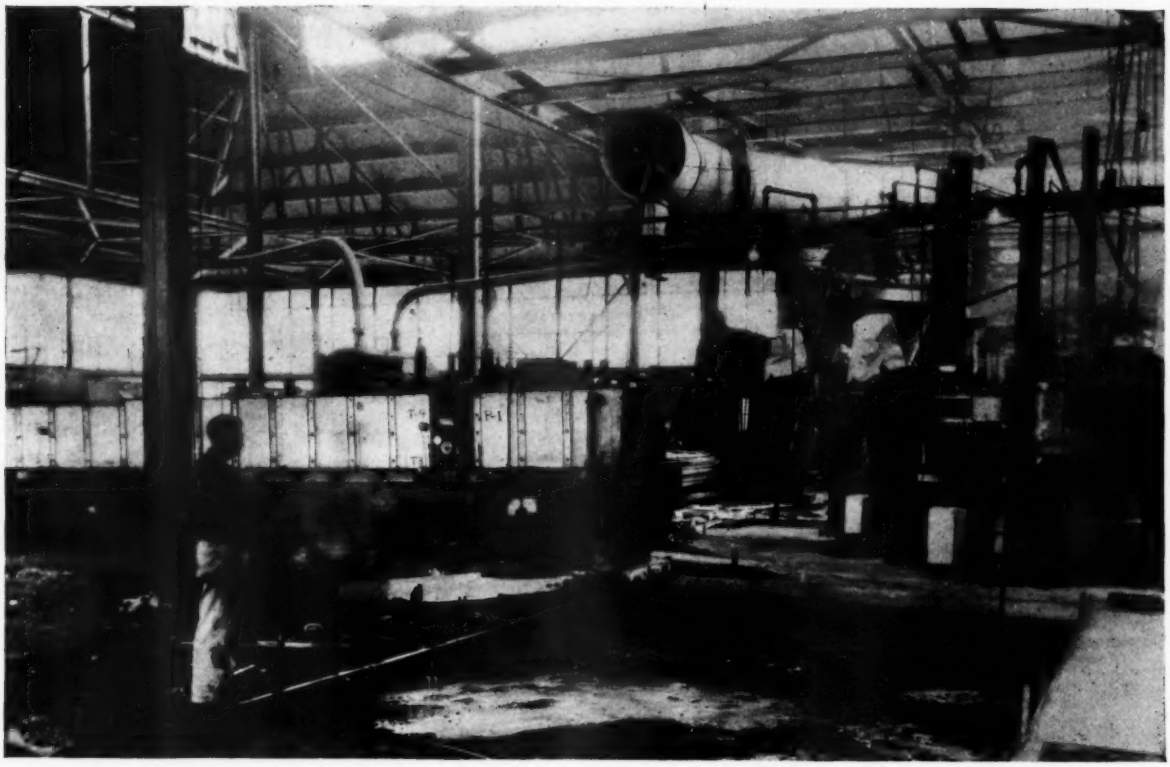
At the upper works the most interesting feature is the new building recently erected to replace one destroyed by fire last March, and the new equipment it contains. A notable installation is that of two Hartford automatic lehrs.

The tank, only partly destroyed, was repaired. It is equipped with four Hartford-Empire plunger feeders and supplies glass to four Lynch blowing machines which fortunately were saved from the fire in good condition. Two 15-foot Dixon lehrs which also survived the fire have been rebuilt.

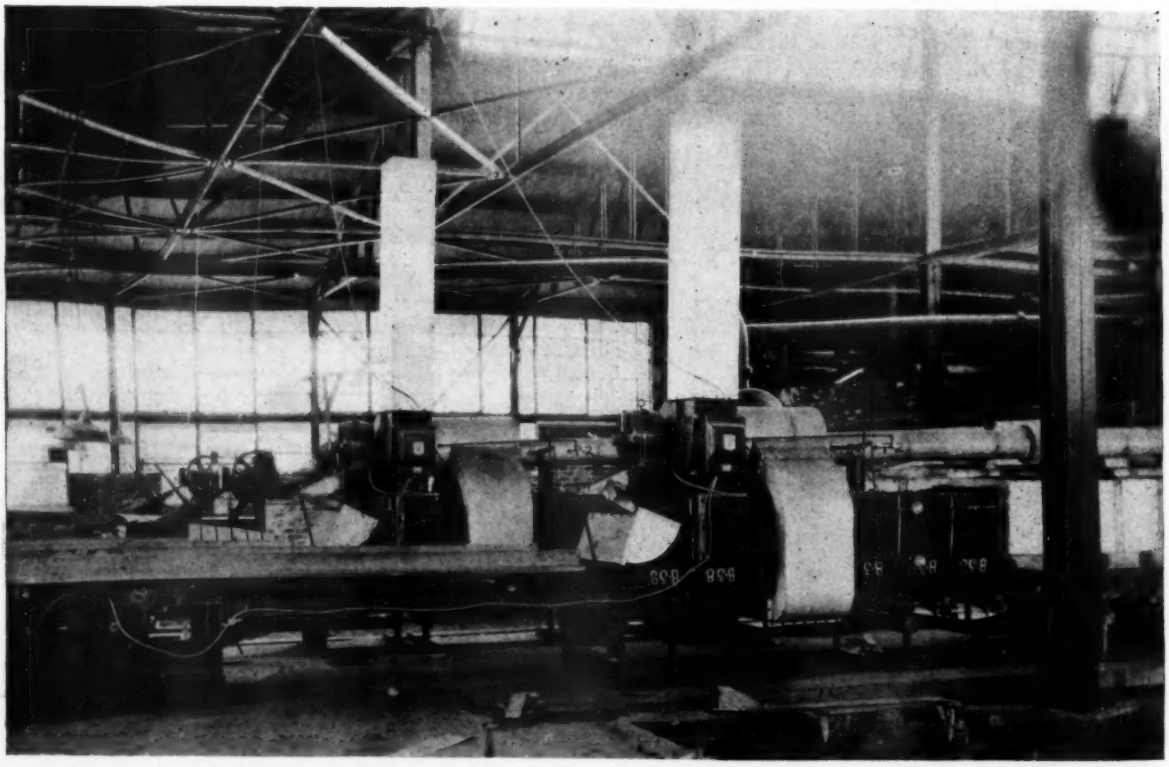
A new wind system of ample capacity, designed and constructed by the B. F. Sturtevant Company and including two No. 5 Turbovanas, is being erected by the glass company's own employes.

In this building several old wood-fired furnaces are still being used for annealing large carboys, with better results,

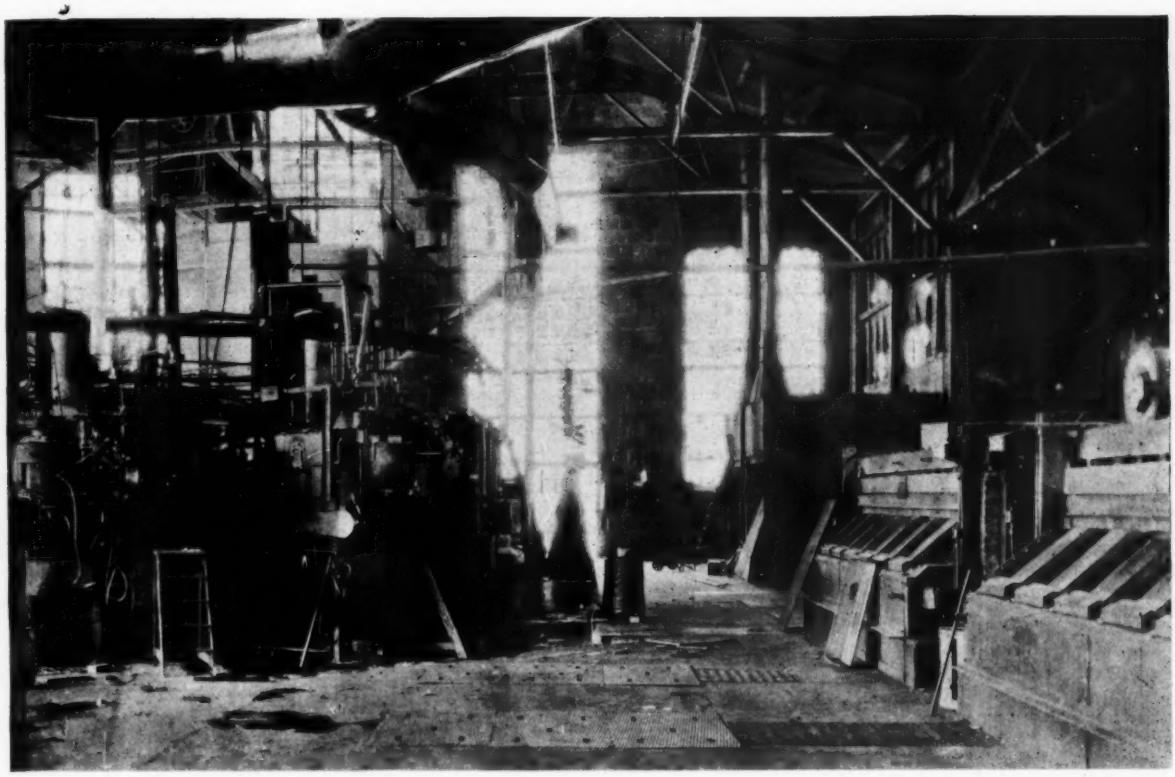
EMPLOYES WITH SERVICE RECORDS OF FORTY-FOUR TO SIXTY-EIGHT YEARS
Photograph taken in 1916 at Whitall Tatum Company Works



INTERIOR VIEW, NEW AUSTIN TYPE BUILDING SHOWING LEHRS, WORKING END OF TANK AND FEEDERS. WIND SYSTEM UNDER CONSTRUCTION



INTERIOR VIEW, NEW BUILDING, SHOWING DELIVERY END OF TWO HARTFORD AUTOMATIC LEHRS AND TWO DIXON LEHRS



ADDITIONAL TANK AT UPPER WORKS EQUIPPED WITH HARTFORD-EMPIRE FEEDERS. AUTOMATIC MACHINES TEMPORARILY REMOVED WHILE CHANGING GLASS FROM LIGHT GREEN TO AMBER

it is stated, than it was possible to obtain in modern lehrs in which tests have been made.

The new building which was designed and constructed by the Austin Company of Cleveland, Ohio, through their Philadelphia branch, represents the latest approved practice in steel buildings for industrial purposes. The design of the structure provides the maximum lighting and ventilating efficiency and wide spans reduce floor obstructions. The building occupies almost exactly the same position and space as the one it replaced, except that it was lengthened a few feet to provide sufficient room for the new lehrs which are several feet longer than were the old lehrs they replace.

The new building, approximately 140 x 160 feet in size, was erected over a temporary building constructed over the tank by the contractor a few days after the fire. Within two weeks furnace operations were resumed and continued without serious interruption while the new building construction was proceeding.

A second continuous tank in another building at this plant is equipped with three Lynch machines and one special machine of the company's own design for making insulators.

Producer gas is used for all melting tanks and annealing furnaces, except the Hartford lehrs for which fuel oil is used. Oil is also used for heating the Hartford-Empire feeders. There is a four-unit producer plant at each of the works, all equipped with Chapman agitators.

Temperature control in tanks and lehrs is provided for in the "Tapalog room." Wilson-Maeulen pyrometer equipment is used in both upper and lower plants.

The power plant at the lower works is equipped with two 300 kw. General Electric steam turbine generators which are in operation alternately, a single generator being sufficient to take care of all requirements. Compressed air is furnished by Ingersoll-Rand equipment. Power used at the upper works is purchased from an outside source.

A complete mold shop is maintained employing at present 48 men. It is equipped with two Keller profiling machines, one capable of cutting two complete molds or four halves, and the other one complete mold, or two halves at one setting. There are also four turret lathes and fourteen 20-inch engine lathes, which are gradually being displaced by turret lathes. There is also the other machine shop equipment usually required for mold making.

In the old days of pot furnaces a large pot making department was operated, but at present no pots are used and only a part of the company's requirements of tank blocks is made at the clay plant, the rest being purchased from block manufacturers.

Numerous buildings were erected at both upper and lower works at various times during past years, and both plants cover large areas. Standard gauge railroad tracks run through both plants and each is provided with its own gasoline driven locomotive, which has proved to be of great value for getting in raw materials promptly and enabling outgoing cars to be loaded with finished products and shipped without delays.

An experimental department and laboratory is conducted in a modern building at the lower plant.

The Composition of Glasses Which Absorb Ultra-Violet Rays*

(From the American Patent Literature)

Glasses containing more than five per cent of titanium oxide, especially those containing also boron, have the property of absorbing ultra-violet rays. They should be melted in an oxidizing atmosphere, using a certain amount of saltpetre. In some cases cerium oxide in the form of cerium nitrate is added and also vanadium oxide; the latter in small amounts. These oxidizing substances prevent the reduction of the metallic oxides during the melting process and increase the absorbing powers of the glass.

This type of glasses has a high index of refraction. They absorb rays of less than 0.365 $\mu\mu$, in sheets of 4 millimeter in thickness, if vanadium is present in amounts of one per cent. If the glass contains 2 per cent vanadium oxide, the same absorbing action is obtained with half this thickness. As examples of the composition of such glasses, the following analyses are given:

	I	II	III	IV	V	VI
Silica (SiO_2)	63.6	61.3	67.0	70.2	70.0	71.1%
Titanium oxide (TiO_2)	12.0	9.8	7.7	4.9	—	—%
Cerium oxide (CeO_2)	—	4.3	—	3.9	3.6	—%
Vanadium oxide (V_2O_5)	—	—	1.0	0.4	1.0	3.5%
Sodium oxide (Na_2O)	16.8	17.6	17.3	14.4	18.0	16.3%
Potassium oxide (K_2O)	2.9	2.6	2.6	2.6	2.8	2.6%
Calcium oxide (CaO)	3.8	3.6	3.6	3.0	3.8	5.7%
Boron oxide (B_2O_3)	0.5	0.4	0.4	0.3	0.4	0.5%
Arsenic oxide (As_2O_3)	0.4	0.4	0.4	0.3	0.4	0.4%

The batches from which these glasses have been made are the following:

	I	II	III	IV	V	VI
Sand	100	100	100	100	100	100
Titanium oxide	19	16	11.5	7	—	—
Cerium nitrate	—	16	—	12.5	11.5	—
Vanadium oxide	—	—	1.5	0.5	1.5	5
Soda ash	46	50	45	36	45	40
Potash	10	9	8.5	8	8.5	8
Marble	11	11	10	8	10	15
Borax	2	2	1.5	1	1.5	2
Arsenic	1	1	1	1	1	1
	189	205	179	174	179	171
Glass yield	83	79.5	83.5	82	80	82.5%

If sufficient amounts of the oxides of cerium and vanadium are present (together at least 4.5 percent), titanium can be omitted. If at least 3.5 per cent vanadium oxide is present, the cerium oxide can also be left out, and yet a strongly absorbing glass will be obtained. Instead of cerium, other rare earths can be used, such as neodymium, praseodymium, erbium, samarium, lanthanum and thorium. However, the great scarcity of the first four elements precludes their use in practice. With regard to the absorbing power of ultra-violet rays, it is interesting to note that titanium oxide is only half as effective as the same amount of cerium oxide. Addition of titanium and cerium together (glass No. II) yields a glass of great absorbing power and great brilliance. In contrast to the German ultra-violet ray absorbing glasses, such as Euphos glass and Hallauer glass, it is almost entirely colorless, which of course is a very great advantage in many cases. Glasses Nos. V and VI can be obtained free from color.

According to a similar patent (U. S. No. 1,414,715), a glass which absorbs ultra violet rays can be made by a combination of the oxides of cerium and manganese, or of vanadium and manganese. An example of such a glass is the following:

Composition.		Batch.	
Silica (SiO_2)	70.7%	Sand	100
Vanadium oxide (V_2O_5)	3.5%	Vanadium oxide	5
Sodium oxide (Na_2O)	16.2%	Soda ash	40
Potassium oxide (K_2O)	2.6%	Saltpetre	8
Calcium oxide (CaO)	5.7%	Marble	15
Boron oxide (B_2O_3)	0.5%	Borax	2
Arsenic oxide (As_2O_3)	0.4%	Arsenic	1
Manganese oxide (Mn_2O_3)	0.5%	Manganese	1

The amount of cerium oxide or vanadium oxide must be from 3 to 6 per cent .

In U. S. Pat. No. 1,305,793 the Corning Glass Works gives the composition of a glass which transmits ultra-violet rays, but which is opaque to the visible rays, and therefore does not transmit these. The amount of nickel which causes this action is from 0.5 to 12 per cent. As bivalent oxide calcium oxide is not used, but zinc oxide, or, better still, barium oxide. Of a series of glasses the following is mentioned as by far the best:

Composition.		Batch.	
Silica (SiO_2)	50%	Sand	100 lbs.
Potassium oxide	16%	Calcined potash	45 lbs.
Barium oxide	25%	Potassium nitrate	10 lbs.
Nickel oxide	9%	Barium carbonate	65 lbs.
		Nickelous hydroxide ($Ni(OH)_2$)	22.5 lbs.

The above mentioned glasses, having strong absorbing powers for ultra-violet rays and which are practically colorless, are very well adapted to the manufacture of protective glasses in the form of light shades, electric light bulbs, spectacles, lamp cylinders, etc. They protect the eyes from the harmful ultra-violet rays emanating from glass furnaces, and melting furnaces of all sorts, foundries, electric arc lights, mercury vapor lamps and from snow blindness. At the same time they transmit all of the visible rays, and are of great brilliance. In contrast with the German glasses they are colorless.

Determining Cause of Opalescence

Various theories have been advanced as to how opalescence in glass is caused. It is now possible to indentify by means of X-rays any material which has actually separated out in a glass. Spectrographic tests have been devised by means of which is now quite possible to determine whether various materials are present or not.—*J. W. Hyde of General Electric Co., Ltd., at the Society of Glass Technology.*

* *Die Glashütte*. Vol. 56, No. 23, p. 444 (June, 1926), translated for GLASS INDUSTRY.

Colorless Glass Production in Tank Furnaces

Part III. The Influence of Arsenious Oxides and Other Constituents of the Batch With Special Reference to the Use of Selenium

By Arnold Cousen, M.Sc., and Prof. W. E. S. Turner, D.Sc.

In previous papers[1] in this series we have recorded experiments designed to determine the maximum amount of iron oxide which can be decolorized by selenium or sodium selenite, the influence of temperature, the duration of the melting period, the action of salt-cake, of sodium nitrate and of borax. Although in the second paper a number of glasses were prepared in which arsenious oxide was employed, a closer examination of the influence of this substance was desirable. This has been done and, in addition, some tests have been made to ascertain what substitutes might be used instead of arsenious oxide.

The Influence of Arsenious Oxide

The meltings have all been carried out with the standard batch: sand 1000, soda ash 370, limespar 200. As the result of investigations previously recorded, it was found that success in decolorizing when selenium was the only constituent added to the above batch was dependent both on the duration of the melting period and on the temperature.

At melting temperatures of 1340° to 1380° and melting periods of 3—3½ hours, it was found possible to bring about decolorizing satisfactorily with selenium alone. At temperatures in excess of 1400° for this same period of time, a yellow or amber color was developed, so that colorless glass could not be produced under such conditions. The same result held good even at temperatures of about 1380° when the period of melting was extended to 8—9 hours.

The addition of arsenious oxide in amount about 50 times the amount of selenium employed, that is, about 25 oz. of arsenious oxide per 1000 lb. of sand, made it possible to prevent the development of the brown color even after 8 hours' melting. The arsenious oxide did not produce this result by elimination of selenium. This was shown by determination of the selenium content in the following two pairs of glasses, one member of each pair containing arsenious oxide, the other being free from it:

Sample No.	Selenium used per 1000 lb. sand.	Arsenious oxide used per 1000 lb. sand.	Percentage selenium in glass.	Color.
262	1 oz.	Nil	0.00062	Pale yellow.
263	1 oz.	25 oz.	0.00075	Faint pink.
267	1 oz.	Nil	0.00045	Pale yellow.
268	1 oz.	25 oz.	0.00040	Faint pink.

It then became of interest to ascertain what minimum amount of arsenious oxide must be added to the batch in order to ensure the decolorizing being of reasonable permanence. A series of meltings of the standard batch with 0.03 part of the selenium and 0.005 of cobalt oxide were made with increasing quantities of arsenious oxide. With small amounts only, the temperature and time factors were of importance. Thus at melting temperatures below 1400° even 2—3 oz. of arsenious oxide per 1000 lb. of sand prevented the development of an amber color; but above this temperature, although the color was reduced, it was not completely suppressed. When the amount of arsenious oxide reached 30 times the selenium unit, or 15 oz. per 1000 lb. of sand, there was no development of color in a melting occupying 3 or 4 hours, but this must be regarded as the minimum of the oxide necessary to secure correct decolorization of the glass.

Analysis of the iron oxide content of many glasses served to show an average iron oxide content of 0.04 per cent in the glass after 3 hours' melting, a value which grew to about 0.08 or 0.09 per cent. at the end of 8½ hours. On the other hand, slabs made from glass melted for the longer period were still free from color, the slight pink obtained generally in the 3-hour melts being either reduced or having quite disappeared. Still the color change was very small and seemed disproportionate to that to be expected from the growth of iron compounds to more than double the former value.

It seemed evident, therefore, that the arsenious oxide exerted some effect on the color of the iron in the glass, tending to reduce its color quite independently of any effect on the selenium.

To test this point, two series of meltings were made with the standard soda-lime-silica batch to which increasing amounts of arsenious oxide were added, the one at 137°, the other at 1400°. The results served to show the powerful effect of arsenious oxide in repressing the color due to iron oxide in the glass, for the tendency toward decolorization was greater the more arsenious oxide the batch contained. The green color was slightly greater in glasses melted at 1400° than in corresponding glasses melted at the lower temperature, but since the proportion of iron oxide absorbed from the pot was less at 1370° than at 1400°, the differences found in the two series would probably be so explained.

TABLE I.

Sample No.	Melt. temp.	Oz. of As_2O_3 per 1000 lb. sand.	Per cent. Fe_2O_3	Color.
369	1370°	Nil	0.05	Yellowish-green.
370	1370	10	0.04	Pale greenish-blue.
371	1370	25	0.04	Very pale blue.
367	1370	100	0.03	Extremely faint greenish-blue.
368	1370	150	0.03	Extremely faint greenish-blue.
329	1400	Nil	n.d.	Yellowish-green.
330	1400	5	0.06	Pale yellowish-green.
331	1400	10	0.06	Pale greenish-blue.
332	1400	25	0.05	Very pale greenish-blue.

When fairly large amounts of arsenious oxide were employed, that is, of the order of 5 lb. As_2O_3 per 1000 lb. of sand, the glass obtained was practically colorless, much more so than many so-called decolorized commercial glasses. This decolorizing action, then, is the first and perhaps the most important function of arsenious oxide when used with selenium of other decolorizers. It renders the color effect due to the iron compounds materially less, and so makes possible the total elimination of color so much the easier. Indeed, it might almost be said that arsenious oxide is the primary de-

[1] Part I, *Journal of the Society of Glass Technology*, Vol. 6, No. 22, (Aug., 1922). Part II, same journal, Vol. 7, No. 8, (Dec., 1923). Part III, same journal, Vol. IX, No. 34, (June, 1925). Part I reprinted in GLASS INDUSTRY, Vol. 3, No. 10, (Oct., 1922).

colorizer and that the selenium and cobalt oxide are secondaries which are introduced to round off and complete the work of the arsenious oxide.

What the precise action of the arsenious oxide is can here only be suggested, but it may be assumed to be the formation of a colorless compound containing iron and arsenic. Since several workers have shown the arsenious oxide of the batch to be largely converted into the arsenic condition in the glass, it is probable that the colorless substance is an arsenate of iron, although, if so, it is remarkable that it should be formed so completely by materials occurring in such small concentrations in the glass as do the arsenic and iron.

The second function of the arsenious oxide seems to be one of suppressing the color of the selenium. Thus, the addition of arsenious oxide to a batch intended for a selenium-decolorized glass, in amount of at least 1 lb. per 1000 lb. of sand (and for safety probably more than this), is apparently a vital necessity.

It may be worth while here to consider the pink color imparted by selenium to the glass, since it is this pink color which is made use of in conjunction with the blue of the cobalt oxide in order to eliminate the final trace of green due to the iron. In a previous paper, we pointed out that the pink color was fugitive when the glass was re-heated to temperatures approximating to the annealing temperature. It was important to obtain evidence as to the stability of the color under melting conditions. Our meltings have shown that the pink color develops at the commencement of melting; for dips taken at the end of the first hour showed the glasses made to be usually pink in color. The pink color has never been found to deepen by prolonging the melting period, the reverse always being the case, a glass which was pink at the end of 3 hours' melting tending to become decolorized on longer heating. This is natural, since the iron oxide content of the glass is constantly growing as heating is prolonged, and so tends to mask the pink selenium colour. Evidence of this fact is given by comparison of glasses from identical batches, both melted at 1400° for a first period of an hour, one glass being maintained at this temperature for a further two or three hours, while the temperature of the second was reduced to about 1350° for the same length of time. The first glass was without color while the second glass was pink. Repeated analysis of glasses made has shown that pot attack is more rapid at 1400° than at 1350°, and the iron oxide content of the glass grows more rapidly at the former temperature.

Comparison was made of glass from the same batch and in one case melted a uniform temperature of 1340—1350°, the other melted for 1 hour at 1400° and then for 2 hours at 1350°; the former was found to be pale green and the latter pink. This result indicates that the selenium is lost to a greater extent in the first case than in the second. This is, indeed, natural for selenium as a volatile element, and unless the batch rapidly melts and encloses it, much of it is liable to be lost. In any case, the loss due to volatilisation is very considerable, as previous analyses by one of us have shown. As far as can be judged, arsenious oxide has little or no effect on the intensity of the pink color, although this statement is given with reserve, since without the addition of oxide the brown color grows and prevents accurate comparison.

The control of the pink color is the most subtle of all the problems confronting the production of colorless glass, since it is affected by several conditions, each of which requires careful control. It would seem, however, that the best results are to be obtained by observance of these rules:

(1) Use materials as low in iron oxide content as possible, and as constant as possible in the proportion of this oxide which they contain.

(2) Keep the selenium content of the bath steady.

(3) Use sufficient arsenious oxide to secure the desired color control; parsimony in the use of this substance may be fatal to the success of the operation.

(4) Melt at a temperature sufficient to secure rapid fusion of the batch.

(5) Avoid prolonged standing of the glass at high temperature, since by such exposure the iron oxide content will more rapidly increase, to the detriment of the color obtained.

Tests on Possible Substitutes for Arsenious Oxide

Although arsenious oxide has thus been shown by us to be of great importance for the successful decolorizing of glass, certain objections occur to its use to any large extent in glass batches and it seemed of interest to endeavor to find out, if possible, a substitute. The most obvious elements to replace arsenic are those of the same group of the Periodic Table and approximating to it in chemical properties, namely, phosphorus and antimony. To find what was the effect of these elements in the glass, four meltings of the standard soda-lime glass were carried out side by side in the same furnace. The first melting contained, in addition to the glass-forming materials, selenium only. The second glass was made by the addition of the usual quantities of selenium, arsenious oxide, and cobalt oxide for decolorizing. The third resembled the second with the exception that the arsenious oxide was replaced by its chemical equivalent of of antimonious oxide, Sb_2O_3. Since the atomic weight of antimony is somewhat greater than that of arsenic, the actual weight of its oxide used was thus greater than that of the arsenious oxide replaced. In the fourth pot the arsenious oxide was replaced by its equivalent of phosphoric oxide added in the form of calcium phosphate. The results were very striking. The glass containing arsenious oxide was completely decolorized. The glass containing calcium phosphate was straw colored—approximately the same tint as that containing selenium only. This showed that the phosphoric oxide has no effect on the color of the glass obtained. The glass containing antimony oxide was a deep bluish-green color, more pronounced than if no decolorization had been attempted. Repeat meltings gave similar results, as will be seen from Table II.

TABLE II.

Glass No.	Wt. of oxide in oz. per 1000 lb. of sand. As_2O_3.	Sb_2O_3.	$Ca_3(PO_4)_2$.	Color of glass.
291	—	—	—	Pale amber.
295	—	—	—	Pale amber.
292	25	—	—	Very faint pink.
296	25	—	—	Very faint pink.
293	—	37.5	—	Pronounced bluish-green.
297	—	37.5	—	Pronounced green.
294	—	—	41	Pale amber.
298	—	—	41	Pale amber.

It seems evident that substitution of arsenious oxide by either antimonious oxide or calcium phosphate is useless for producing a glass decolorized by selenium.

Summary

The experiments detailed in this paper serve to show that arsenicus oxide is a necessary factor in the decolorizing of glass by selenium. The actual amount of it required is influenced by the time and temperature of the glass melting, but as a general rule the minimum amount of arsenious oxide employed should be 30 times that of the selenium. Arsenious oxide itself acts as a decolorizer. Neither antimony oxide nor calcium phosphate was found to serve as a substitute for arsenious oxide in decolorizing glass under the conditions of our tests.

Discussion

MR. W. J. REES: A good deal of discussion has occurred from time to time as to the precise reactions taking place when arsenious oxide was added to a glass batch. Many years ago now he had occasion to investigate this problem, and it had reference to the addition of arsenic to batches containing coal as a reducing agent. He obtained some rather interesting results, which tended to show that in salt-cake batches the arsenious oxide behaved as an oxidizing agent. Coal was used in a proportion to reduce the salt-cake, and the amount of arsenic was equivalent to about 3 lb. of white arsenic per 1000 lb. of batch. At the time these experiments were undertaken the price of arsenic was going up very rapidly, so that it became a question as to whether it was possible to reduce the proportion of arsenic used in the batch. Reductions were accordingly made, and very careful observations kept as to the behavior of the melting, the color of the glass, and so forth. They found that, as the arsenic was reduced, the glass became relatively unstable so far as the color was concerned, and when the arsenic was completely eliminated—as ultimately in the experiments it was—the glass became very sensitive to what was referred to as "smoking." There was a tendency towards the formation of very brown glass, and after a few days' melting with no arsenic at all, the whole of the glass at the melting end became of slightly brown color. The amount of arsenic was then progressively increased again, and as it was increased, so the brown color was eliminated, the brown color gradually passing through blue and then green to normal. It was quite evident at that time that in salt-cake batches containing coal, or any other form of carbon, as a reducing agent, it was essential to retain arsenic as a constituent of the batch, and from observations as to its behavior, and from analysis of the glass, they formed the conclusion that the arsenious oxide acted as an oxidizing agent.

Antimonious oxide behaved in just the same way as the arsenious oxide in improving the color of the glass. It acted as an oxidizing agent. That the color of the glass was improved when arsenious oxide was used had been well known to manufacturers of ordinary glassware for quite a long time, and it was now becoming generally known also that antimony acted in the same way. In some ways, antimony has more durable properties than arsenic as a clearing agent. The higher temperature at which it volatilized in comparison with arsenic was, in some cases, rather an advantage.

MR. W. R. DALE: The effect of arsenic in glass batches in tank practice seemed to have been always a bit of a mystery. He supposed most manufacturers have used arsenic to some extent, but so far as his experience went, no two manufacturers expressed quite the same opinion as to what arsenic really did. He thought he had, that day for the first time, heard arsenic referred to as a decolorizer. He should just like to say what their experience had been in regard to the use of arsenic in decolorized glass. When they first tried to make a decolorized glass in a tank, they did not for the first few weeks get the color they desired. There was a distinct bluish-green tint present. It was suggested they should try extra arsenic. They did put in an extra quantity of arsenic and got the result desired, but, unfortunately, they had also made another change simultaneously, and it was not possible to tell precisely which of the two things it was that achieved the result. On the later occasion, a green color in the glass was removed by adding further arsenic. He regretted he could not give figures in a sufficiently exact form for this particular meeting.

PROF. W. E. S. TURNER said that those manufacturers who were members of the Glass Research Association and received the bulletins of that Association would know that the subject of arsenic in glass had been systematically investigated. He thought Mr. Cousen had intimated quite clearly that the addition of arsenious oxide did remove the color which small amounts of iron oxide give to glass. It was possible to obtain practically a decolorized condition. He wondered, indeed, if it was not actually possible to use arsenious oxide as a decolorizer alone. There were one or two other matters which would be of interest to examine in carrying further their investigation, such as, for instance, the limit of cobalt oxide which can be used; the possibility of using sodium arsenate instead of arsenic, and so on. These points required still further investigation, the determination of the iron oxide being considered side by side with the color of the glasses, so that they might be quite sure of the ground on which they are working.

MR. COUSEN: Very few points remained to be answered. In reply to Mr. Rees, and with regard to the color changes in the iron due to arsenic, to an extent he quite agreed with what he said. If one observed the range of glasses to which arsenic had been added, it would be found that the color changed from a yellowish green down to a blue, and ultimately to a colorless glass, when using arsenious oxide; but with regard to antimony meltings carried out with exactly the same chemical equivalent as the arsenic and containing selenium also the color was essentially different. It had already been noticed by other workers that a large amount of antimony oxide added alone to glass did not serve as decolorizer.

In regard to Mr. Dale's remarks, he thought he had better leave replying to him until they had some idea of his figures. He would say, however, that not only did the arsenic affect the color, but the conditions of the tank, changes of temperature, and such like, made a vast difference to the color that resulted. It was essential whatever decolorizer was used that the temperature should be kept constant; otherwise variations in color would assuredly be obtained.

Mullite and Its Industrial Application*

By M. L. Freed†

The crying need for a real super-refractory has caused a great deal of research work to be conducted for over a score of years. A refractory was sought that would have a high and definite fusion point, the ability to carry heavy loads at high temperatures, to resist slagging action, and to withstand sudden temperature changes.

The recent discovery in India, by Henry A. Golwynne, of commercially available deposits of minerals of the sillimanite group, which when calcined produced mullite, led to investigation by M. L. Freed, research associate for Mr. Golwynne, at the Bureau of Standards, on a study of mullite refractories.

A typical chemical analysis showed the recalculated Al_2SiO_5 value to be over 90 per cent for the regular run of mine and over 98 per cent for hand selected specimens.

The crude rock was crushed and calcined at 1,450° C., until all the material was wholly converted to interlocking mullite crystals and a siliceous glass.

A series of bricks was made by the dry press process, using pure mullite and various mixtures of mullite with clay. The pressed brick was dried and fired at 1,500° C. for three hours (cone 19). The pure and clay bonded mullite brick after firing showed a maximum linear change of 0.62 per cent contraction (shrinkage) in length, and no change in width.

When subjected to the standard low test following the method of the A. S. T. M. for "high heat" duty refractories (serial designation C-16-20), the test was not found to be sufficiently severe.

When the pure mullite brick was subjected to a low test of 50 lbs. per sq. in. at 1,500° C. and maintained for 1½ hours, the deformation was only 2.85 per cent. The mullite brick bonded with 25 per cent of clay withstood a load of 25 pounds per square inch at 1,400° C., maintained for 1½ hours and showed absolutely no deformation whatever.

The softening point test was carried out according to a method used by the Bureau and known as the A. S. T. M. Standard Method (serial designation C-24-20). The results in terms of cone numbers are as follows:

RESULTS OF SOFTENING POINT TEST

Pure mullite—remained rigid at cone 35.

Mullite plus 25 per cent ball clay—remained rigid at cone 36.

Mullite plus 25 per cent fire clay—softened between cones 36 and 37.

No attempt was made to determine the exact softening point of the pure mullite. The ability of the pure mullite to remain rigid at cone 35 was sufficient to show that the life of the pure brick in actual service would be excellent so far as refractoriness is concerned.

The resistance to spalling was determined by a quenching method which followed in principle the tentative A. S. T. M. method. It consists of heating the bricks at one end of the kiln door to 850° C. and plunging them half way into water. The bricks are allowed to remain in the water 3 minutes, taken out, allowed to steam in the air for 5 minutes and then returned to the kiln door. The process is repeated in hourly cycles until the entire end of the brick has spalled off or can be easily removed by the fingers, which is interpreted as failure. Five bricks were quenched and the results reported as the average number of quenchings required to produce failure.

Both the pure and clay bonded mullite bricks exhibited excellent resistance to spalling as evidenced by the fact that after 73 quenchings no spalling had occurred. The tests were discontinued because 73 quenchings without failure proved without a doubt the remarkable ability of the bricks to resist sudden temperature changes or spalling.

A 1 x 1 x 6 inch bar of mullite was found to expand uniformly from 20° to 1,000° C. with a coefficient of 0.0000056. When expansion in percentage increase is plotted against temperature in degrees, a perfectly straight line is obtained. To this remarkable property may be attributed the excellent resistance to spalling as shown by the heretofore unobtained number of 73 quenchings without failure.

A slag erosion test as developed by the Bureau was conducted to determine the relative resistance of the bricks to the combined action of molten slag and flue gases at high temperatures.

A test chamber approximately 24 x 24 x 4½ inches inside was built into a laboratory kiln. The test bricks formed a baffle wall against which the flame from a compressed air burner impinged. This flame carried with it finely-ground slag introduced through a refractory tube by a slow stream of air just above the burner and so directed that the slag was distributed upon the crest of the flame impinging on the test panel.

The interior of the kiln was brought to 850° C. and maintained at this temperature throughout the test by means of the burners at the side which are used regularly in firing the kiln. The temperature of the interior of the test chamber was raised to 1,450° C. by means of the compressed air burner and maintained there for four hours, during which time four pounds of slag were gradually introduced through the refractory tube as described.

The finely-ground slag, falling into the flame, was picked up, the finer grains were melted almost instantly and the entire charge was carried against the test bricks in the cover of the test chamber. The slag flowed down across the face of the test panel at the back and was retained in the pocket at the bottom while the flame swept on and down to the recuperator through two flue holes left in the side walls of the test chamber.

The slag had a softening point of 1,100° C. and was prepared in the laboratory by calcining and grinding (to pass 100 mesh) the proper raw materials to approximate a

* Abstract of paper presented at the Annual Meeting, American Ceramic Society, Atlanta, Ga., Feb., 1926. *J. Am. Cer. Soc. Vol. 9, pp.* 249-256.
† Research Associate for Henry A. Golwynne.

high sulphur, low fusing coal ash of the following composition. (Analysis obtained from Bur. Mines, Bull., No. 209, p. 2.)

SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	Na_2O	K_2O	SO_3
30.7	19.6	18.9	1.1	11.3	3.7	1.9	0.5	12.2

The bricks showed only slight signs of erosion, comparing favorably with the most resistant clay brick.

When the bricks under test were cut through, no signs of penetration were visible in the pure or clay bonded mullite bricks while the fire clay bricks tested alongside the mullite bricks showed signs of penetration of over an inch.

CONCLUSION

Mullite, pure, or bonded with clay, produced refractory bodies capable of withstanding standard and modified laboratory tests for high grade refractories. The bodies were highly refractory and showed excellent resistance to deformation under load and to spalling. They also showed a uniform rate of thermal expansion.

The above described results, together with those obtained in England using mullite in glass works, indicate that the prospects for the development of mullite as a "super refractory" for the glass industry appear very favorable.

Inside-Frosted Lamps

Growing appreciation of the importance of good electric lighting during the decade between 1915 and 1925 led to much wider use of diffused light. Diffusion by enclosing the lamps in translucent glassware and adequate shades and by using other devices was a vague subject to the public.

Consequently with the advent of the high-efficiency tungsten lamp, the manufacturers endeavored to conceal the bright filaments by etching or frosting the bulbs. Frosting on the outside of the bulb proved objectionable for two chief reasons. It was wasteful of light, offsetting, to a slight degree, the great progress made in increasing the light-producing efficiency of the filament. Also, outside-frosted lamps collected dust and dirt quickly, which could not easily be wiped off.

For many years lamp engineers realized that a lamp frosted on the inside, instead of on the outside, would be very desirable. It would not only present a smooth outside surface and be as easily cleaned as a clear lamp, but a lighter frosting would suffice, increasing the efficiency. The trouble with the idea was, that when a lamp bulb was frosted on the inside, it became as brittle as an egg shell. For twenty years engineers wrestled with this problem to no avail, until Marvin Pipkin, of the National Lamp Works of the General Electric Company, solved the difficulty by a simple method.

A strong solution of acid is first sprayed into the bulb, which etches it. In this condition the surface of the glass is made up of irregular little projections with many sharp angles. While the glass is still in this state it is extremely weak, and a slight pressure or bump is sufficient to shatter it. So far, the process is similar to former attempts at inside frosting. The difference lies in the strengthening process, which is the application of another acid solution, somewhat weaker than the first. This second treating rounds off the sharp edges and minute projections, giving the glass an appearance, under a powerful microscope, of being made up of tiny hemispheres. The bulb is now strong again,—just as strong as it was originally.

Superiority of the inside-frosted lamp over the outside-frosted, so far as light transmitting characteristics are concerned, also needs explanation. In the outside-frosted lamp, light from the filament travels through the gas or vacuum to the wall of the bulb, then through the glass, on the outer surface of which it meets the frost. Then, depending upon the direction of the plane of the particle of rough surfaces, the beam either passes on through the frosted surface as useful light or is reflected back through the glass layer. Each time the light passes through the glass, a certain amount of absorption takes place.

Diffusion of the light by the inside frost is obtained by prismatic refraction with comparatively little loss. In fact, the inside frost allows an even greater portion of the light to pass through than does a similar frost on the outside of the lamp. This is due to the fact that the multiple internal reflections are not so numerous in the inside frosted lamp because the rough, interior surface does not reflect any considerable portion of the light back and forth inside the lamp, as happens with the outside-frosted lamp. Moreover, the relative absorption of the inside frost does not increase so rapidly with the life of the lamp as does that of other diffusing media.

For these reasons, then, the inside-frosted lamp is only about two per cent less efficient than a clear lamp, contrasted with a loss of efficiency of three to four times this much in the old style sand-frosted and sprayed lamps.

Another great benefit of the discovery of inside frosting is at once apparent when it is realized that now the manufacturers need only one type of lamp of each wattage instead of lamps with several different finishes. This is beneficial not only from the standpoint of economies resulting from the increased use of automatic machinery and the decreased investment in lamps lying idle in warehouses and on dealers' shelves, but also there is still greater benefit for the public in general. Since the inside-frosted lamps give practically as much light as clear lamps, they can be used to replace clear lamps for every ordinary use. This means that wherever, because of ignorance or carelessness, lamps are used without proper shades or glassware, the inside-frosted lamps will afford a certain degree of eyesight protection. Furthermore, wherever lamps are properly shaded, the inside frosting will eliminate sharp shadows and striations, with negligible loss of efficiency.

The invention of the inside-frosting process, of the same order of importance as the invention of gas-filled lamps and tipless lamp construction, is one more example of the value of systematic research, persistently pursued.—*Research Narratives.* Vol. 6, No. 8.

The Laboratory

The Valuation of Zinc Oxide

The earliest use of zinc as a constituent of glass was made by the French glass manufacturer Maës, at Clichy, near Paris. Objects made of this glass were exhibited at the London exposition of 1851, and were pronounced to be of excellent quality by the optician Ross of London. It had approximately the following composition:

Silica (SiO_2)	56%
Boric acid (B_2O_3)	7
Potassium oxide K_2O	17
Lime (CaO)	2
Zinc oxide (ZnO)	14
Lead oxide (PbO)	4

For some time it was believed that the use of zinc oxide might become more general, and take the place of lead oxide, to some extent. It is considerably cheaper than lead oxide. Moreover, on account of its lower molecular weight, one part of zinc oxide can take the place of 2.75 parts of lead oxide.

Properties of Zinc Glasses

The refractive index of glass increases with greater molecular weight of the oxides used in its manufacture. For this reason, zinc glass is more brilliant than lime glass, and less brilliant than lead glass, if the quantities of these oxides are used in the proportions of the equivalent weights of lime, zinc oxide and lead oxide, which are respectively 56, 81 and 223. The refractive index of zinc glass lies between that containing equivalent quantities of lime and barium oxide. For this reason zinc crown glass has an important place in the series of optical glasses.

The outstanding property which zinc gives to glass is a great decrease in solubility[1]. This makes it a desirable addition to glass intended for the manufacture of chemical glassware.

The coefficient of thermal expansion of glass may be calculated from the chemical composition, according to the formula:

$$P = a_1 y_1 + a_2 y_2 + a_3 y_3 + \ldots\ldots$$

In this formula, P is the coefficient of thermal expansion, a the percentages of oxides and y the correspondent values for thermal expansion. The values for y are:

SiO_2 ....0.8	MgO ...0.1	Na_2O ..10.0	TiO_2 ....4.1
B_2O_3 ...0.1	Al_2O_3 ...5.0	K_2O 8.5	MnO_2 ...2.2
ZnO 1.8	As_2O_5 ...2.0	CaO 5.0	Fe_2O_3 ..4.0
PbO 4.2	BaO 3.0	P_2O_5 ....2.0	CuO 2.2

This table shows that with the exception of boron, magnesium and silicon, zinc has the lowest coefficient of expansion. This property, combined with the low solubility makes zinc glasses valuable for chemical apparatus, which require a strong resistance against sudden changes in temperature. This property is further enhanced by the presence of boron. As a result the well-known Jena chemical glassware has been developed, having the following composition:

	SiO_2	Al_2O_3	ZnO	BaO	B_2O_3
I	65	3.3	4.6	12	15
II	68	3.7	3.7	12	13

It has been found that glasses containing zinc are especially fitted for use as thermometer tubes, due to the fact that zinc decreases the depression of the zero point. The well known Jena Normal glass 16^{111}, which is adapted for clinical thermometers has the following composition:

Silica (SiO_2)	66.8%
Boric acid (B_2O_3)	2.0
Alumina (Al_2O_3)	2.5
Sodium oxide (Na_2O)	14.5
Lime (CaO)	7.0
Zinc oxide (ZnO)	7.0
Manganese oxide (MnO)	0.2

Zinc may be introduced as zinc oxide, known as zinc white or as basic carbonate of zinc. The latter has a variable composition.

Technology of Zinc Oxide

The most important ore of zinc is sphalerite, also known as "blende" or "blackjack." It is zinc sulphide, ZnS. It occurs in the Mississippi Valley Region, of which the Joplin, Missouri, area is the most important. Another zinc-producing region is Sussex County, New Jersey, where franklinite, $(FeMnZn)O,(FeMn)_2O_3$ and willemite, $2ZnOSiO_2$, are found in large deposits. Franklinite is not used to produce the metal, but to manufacture zinc white. Its residue is utilized to make ferro-manganese. Blende must be roasted to remove practically all of the sulphur.

The pulverized ore is mixed with anthracite coal, or with a mixture of coke and soft coal, and is charged into a retort in which it is heated by producer gas or natural gas. The vapors coming from the retorts are burned with air to form zinc oxide.

Qualitative Analysis

Pure zinc oxide is soluble in acids without effervescence, and without leaving any residue. Zinc oxide often contains some zinc carbonate, which gives off carbon dioxide upon addition of acids. Strong evolution of gas may indicate the presence of calcium carbonate, added to adulterate the product.

Addition of caustic soda or potash gives a precipitate, which must be complete soluable in an excess of the reagent. A reddish, flocculent precipitate, insoluble in an excess of caustic alkali, indicates iron.

When the acid solution is neutralized with ammonia, a pure, white precipitate should be formed upon addition of ammonium sulphide. Dark coloration of the precipitate indicates the presence of iron, lead or copper.

Quantitative Analysis

TOTAL ZINC OXIDE. Dissolve 20 grams of the sample in dilute hydrochloric acid, gas with hydrogen sulphide and

[1] For a discussion of the influence of the different glass forming oxides on the solubility of glass, compare "Dralle, Die Glasfabrikation," Vol. I, p. 83.

wash the precipitate with acid hydrogen sulphide water. It is preserved for the determination of lead and copper.

Boil the filtrate until free from hydrogen sulphide, add bromine water to oxidize free sulphur and sulphide and remove the excess by boiling. Dilute in a standard flask to 2,000 cc. and aliquot 50 cc. Add ammonia until a precipitate is formed and dissolve the latter in 90 per cent formic acid, adding about 15 cc. in excess.

Gas the solution with hydrogen sulphide, allow the precipitate to settle on a steam plate, filter and dissolve in a hot mixture of 1 vol. hydrochloric acid and 4 vols. bromine water. Boil and concentrate to about 100 cc., adding more bromine water if necessary. The zinc may be determined in this solution by precipitation with diammonium phosphate in neutral solution and weighing as zinc pyrophosphate, or by precipitation as zinc mercuric thiocyanate in acid solution. According to the latter procedure, add to the hydrochloric acid solution an excess of mercuric thiocyanate reagent (see below), stir well, allow to settle and filter through a tared perforated crucible. Wash with water containing 20 cc., mercuric thiocyanate reagent per liter, dry to constant weight at 105 degrees C, and weigh as $ZnHg(CNS)_4$.

$$\text{Calculation: } \frac{\text{Weight } ZnHg(CNS)_4 \times 0.16331 \times 100}{\text{Weight of sample}} = \% \text{ ZnO.}$$

Mercuric Thiocyanate Reagent: Dissolve 27 grams of mercuric chloride and 39 grams of potassium thiocyanate in a liter of water. Filter before using.

Determination of Lead and Copper. Transfer the paper and precipitate of the sulphides to a beaker, add 5 cc. sulphuric acid and some fuming nitric acid to destroy the filter paper. Heat, expel the nitric acid and allow to cool. Add water and 95 per cent alcohol and allow to stand for several hours. Filter through a tared perforated crucible wash with acidified alcohol and finally with 95 per cent alcohol until free from acid. Reserve the filtrate for the determination of copper. Dry to constant weight at 200 degrees C., and weigh as $PbSO_4$.

$$\text{Calculation: } \frac{\text{Weight of } PbSO_4 \times 0.68324 \times 100}{\text{Weight of sample}} = \% \text{ Pb.}$$

Copper is determined in the filtrate by electrolysis or by the colorimetric procedure.

Determination of Iron. Pipette 100 cc. of the original solution of the sample into a beaker, add about 5 grams of ammonium chloride and an excess of ammonia. Filter the precipitate, dissolve in hydrochloric acid and reprecipitate with ammonia. Dissolve in a little hydrochloric acid, add ammonia until neutral and add one to two cc. of hydrochloric acid. Cool to room temperature, add 10 cc. of a 50 per cent solution of potassium iodide (free from iodate) and allow to stand 10 minutes. Titrate the liberated iodine with standard N/20 sodium thiosulphate solution, using starch indicator.

$$\text{Calculation: } \frac{\text{cc. N/20 } Na_2S_2O_3 \times .002792 \times 100}{\text{Weight of sample}} = \% \text{ Fe.}$$

If copper is absent, the precipitation of the iron with the ammonia may be omitted, and the potassium iodide solution added directly to the solution of the sample, after adjusting the acidity.

Determination of Manganese. Pipette 100 cc. of the original solution of the sample into a beaker, add 10 cc. of sulphuric acid and evaporate to fumes. Allow to cool and add 150 cc. of nitric acid (1:2), and boil until the residue is completely dissolved. Add a few drops of silver nitrate solution to remove chlorides, cool to 15-20 degrees C., and add 2 grams of sodium bismuthate. Filter through asbestos, wash with 3 per cent nitric acid and titrate the permanganic acid formed with N/20 sodium arsenite solution.

$$\text{Calculation: } \frac{\text{cc N/20 } Na_3AsO_3 \times .000824 \times 100}{\text{Weight of sample}} = \% \text{ Mn.}$$

Sodium arsenite solution, N/20. Dissolve 2.48 grams of arsenious oxide in 20 per cent sodium hydroxide solution. Neutralize with dilute sulphuric acid (to phenolphthalein). Add 500 cc. of water containing 25 grams of sodium bicarbonate. If a pink color develops, destroy with a few drops of sulphuric acid. Dilute to one liter, standardize against N/10 permanganate, which has previously been standardized against sodium oxalate.

1 cc. N/20 Na_3AsO_3 = .000824 gm. Mn.
1 cc. N/10 $KMnO_4$ = .001099 gm. Mn.

Correction

In the article under "The Laboratory," page 192, August issue, the first sentence of the second paragraph in the right-hand column, reading "Iron must be absent, or if present should not exceed 0.1 per cent," should read, "0.01 per cent."

Revised Specifications for Table Glassware

The United States Government master specification No. 121, for Glass Tableware[1], was adopted February 20, 1924. The first revision of this specification, which was approved July 27, 1926, differs from the original in two essential respects. The first is a change from 11 to 10 fluid ounces for the capacity of the specified tumbler and the second, the introduction of permissible variations from specified requirements.

The specification describes the following glass articles in the sizes indicated:

Article	Capacity Fluid Ozs.	Weight Ounces	Diameter Inches	Height Inches
Tumbler	10.0	12.0	[1] 2⅞	4¼
Vinegar bottle	14.5	18.5	[2] 3⅝	8¾
Syrup pitcher	20.0	32.0	[2] 4	6⅜
Salt shaker	3.0	....	2¾	4
Pepper shaker	3.0	....	2¾	4

[1] At top.
[2] At bottom.

Tolerances in measurements and weights are as follows: Dimension, ±3; capacity, ±4; and weight, ±6 per cent.

The specification includes detail drawings to show the general shape of each article which may be made by machine or by hand from either a lime or lead glass.

[1] See Glass Industry, May, 1924, pp. 79-80.

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An American Ceramic Institute

A subject of great importance to the American glass industry is being discussed at the Summer Meeting of the American Ceramic Society now in session at Philadelphia. The technical program on September 1st is devoted principally to a discussion of the various agencies available for research.

Ross C. Purdy, secretary of the society, will again present for discussion the proposal of an American Ceramic Research Institute. The idea of a Ceramic Institute was first presented in May, 1924, and was discussed at the Columbus meeting in February, 1925. At the meeting held in Atlanta, the subject was not touched upon and not until the present meeting has there been any mention of this important project. This does not mean that it has not received serious consideration from its sponsors. In the beginning of August a circular was sent to the members of the American Ceramic Society, reprinted elsewhere in this issue. It sets forth the plans as conceived at the present time, and shows how consideration and discussion has modified the original conception.

One of the principal features of the plan is the appointment of a chief research advisor, who will have a staff composed of representatives from each supporting trade association. This advisory staff would study the problems proposed for investigation and would be in a position to advise the association interested as to the means of carrying out research by existing agencies, such as the federal bureaus, universities or institutions such as the Mellon Institute of Industrial Research.

As THE GLASS INDUSTRY understands the proposal, it would amount to the creation of a research agency that would devote all of its time to promote the object for which it is intended. At the present, the committee is not in a position to carry on the work properly. It is manifestly impossible to expect men, engaged in their various lines of work to expend more time and thought than they are already giving now.

This journal has consistently advocated the creation of a central organization to carry on research that will be of benefit to the glass industry as a whole. We have in these columns proposed the organization of an American Glass Research Association, or of an American Glass Institute, similar to those founded by the enamel, terra cotta, white wares and refractories industries. From its first issue we have dedicated this publication to the application of science to the problems of the glass manufacturer. We are still of the opinion that an American Glass Institute would prove to be the greatest step forward that the glass industry could take. However, since its organization does not appear to be feasible at the present time, we are convinced that the plans as proposed by the secretary of the society are the best that can be hoped for, and should be given the fullest support.

The number of problems that are pressing for solution is considerable, but none is more urgent than the clearing up of the deficiency in our knowledge regarding the proper glasses to be used in automatic machines. The development of mechanical devices to work glass has reached a stage where there is little need for improvement. Progress now depends on the development of glasses better adapted to the demands

of machinery in its various forms, and the building of apparatus to adequately control the properties desired. Only organized research can hope to accomplish this end, and the Ceramic Institute, as now proposed, promises to offer a means to do it.

Technical Consultation Service

Closed or Open Pots?

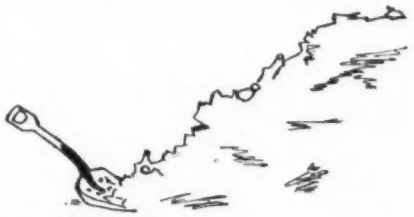
QUESTION 100.—(From Holland). We are considering an extension to our stemware department, and on examining the pros and cons of open and closed pots, should like to know whether it is to be recommended to use open pots for this purpose or closed pots. The stemware manufactured includes crystal, one-half crystal and colored glass tumblers, goblets, decanters, etc., also bulbs for electric lamps. The fuel used is coal only.

ANSWER.—Inasmuch as you use lead in your batches it would be desirable to use closed pots, since the gases of combustion would have a reducing effect on the lead oxide, resulting in a dark color. It is our belief that closed pots are especially needed when raw producer gas is used. However, even in the natural gas fields here, where the finest quality of gas is available, we have never seen any open pots used for glassware containing lead.

In this country electric light bulbs are made without the use of lead. We do not know whether you desire to make lead-free glass for this purpose; if this is the case you could use open pots for this kind of glassware.

Colored glass usually is made more successfully in closed pots, even if it does not contain any lead. However, the colors are so much better when lead is used, that in all cases where it is possible we prefer to use it.—J. B. K.

CULLET PILE PHILOSOPHY



By SILICA SAM

Stay on the Same Course and Repeat

We are constantly advised to study our failures, in order that we may not make the same mistake twice.

I suggest that this advice should be reversed, and that we study our successes, in order that we may repeat them. To avoid failure is a negative thing; to repeat success is positive.

Half the trouble with most of us is our failure to follow up success. We find ourselves making progress along a certain line, and instead of following this line, building success on success, our temperament leads us into by-paths, or we get an inflated notion of our genius and veer off the main road completely.

So, I say, let us develop our strong points, and worry less about our weaknesses, our failures. Life is short and we can't hope to become perfect. At best most of us can develop our talent only in one direction. If we are unwilling to fail anywhere along the line we may never have a worth-while success.

The Working Foremen

"To take hold with my two hands and labor or not to?" is a problem to many foremen or supervisors. "Can he lead and direct best when working alongside his men?" is a question for superintendents.

It depends upon the man, the foreman, and upon his men. The foreman should by all means be able and willing to pitch in. If his men are good true blue workmen they will respect his ability and his inclination. If he does the work well and with the proper manner his doing it will be an inspiration to them. It should accomplish—better workmanship and a better relationship of understanding and mutual respect between the foreman and his men.

It should not be overdone—men are apt to step back and let "the boss" do it if he will. Then, too, "the boss" may be overlooking an angle, a better way or another matter that deserves part of his attention, when too busy with his hands. He must guard against this. He should never replace one of his men for more than just a very few minutes occasionally for illustration purposes.

But give me the foreman that occasionally, yes frequently, with the spirit of—"Come on men, let's go" can take hold of the job with them and make it move. If he's a real leader, and nine to one he is, it will move more quickly and better. The foreman who doesn't dare to soil his hands will never inspire his men to their utmost efficiency.

A man with a go-to-hell exterior often has a wistful interior and will be a true friend to the fellow that tries to make one of him in spite of the first impression.

Laying the Cards on the Table

A glass factory superintendent declares that foremen's meetings furnish his greatest help and inspiration. Of course, they must be that or more to his foremen.

Rumors that seem to start themselves and that cause unrest and trouble among employes are found afloat in organizations where all plans and policies, regardless of how inconsequential they may be, are kept strictly secret. Many of us remember the endless supply of wild rumors and grumbling that used to be chewed over and passed on in the army. Ignorance of facts and plans, it would seem, accounted for them. In that great organization and in war time particularly it was, of course, necessary to keep those things absolutely secret.

Probably it is necessary in industrial organizations to keep a few things which concern the men a secret from them. But the fewer the better.

Occasional foremen's meetings afford the ideal time and place to spread information concerning the men, the product, methods, policies, plans, etc., before one's organization. Then correct information goes out to the last man through the proper channels. Men knowing they will get the straight story at the proper time in this manner are happier, better satisfied and less apt to listen to "Calamity Jane" predicting a shut down, a wage cut, an earthquake or whatnot.

There is a saying that an executive cannot afford to do anything he can hire someone else to do. This is about half bunk and half truth. An executive would be foolish to neglect work in order to seal and stamp his outgoing mail. He would be equally foolish to have someone stand by a whole day to do some simple task which he could do for himself in fifteen minutes.

Tolerance

We speak of "tolerance" or the permissible range of imperfection in fitting parts to allow for limitation of tools, material and workmanship. We make gauges by which to test our product and allow ourselves a reasonable "tolerance."

As social beings, we must have tolerance. Tolerance is intelligence realizing its own fallibility; it is the open mind seeking to learn the innate worth of what may seem strange or distasteful; it is good will, whose horizon is not bounded by self-interest; it is imagination, which can conceive of good in outlooks and conditions other than its own. It sees the great good of the creative impulse beyond the evils of present error.

Do we gauge our fellow men, our employer or employee with *tolerance* in our hearts?

The best reason for avoiding conflicts is that both sides lose.

Proposal for an American Ceramic Institute Discussed

One of the important subjects coming before the summer meeting of the American Ceramic Society now in session at Philadelphia, is the need in the ceramic industries for an organization that will initiate and carry on systematic co-operative research for all of them.

Ross C. Purdy, secretary of the society, has renewed the proposal made two years ago for the establishment of an American Ceramic Institute and discusses it in a circular recently issued to members, which is reprinted below.

What action, if any, the meeting will decide upon concerning the proposal is not known at the time of going to press.

By Ross C. Purdy

Secretary, American Ceramic Society.

RESEARCH BY TRADE ASSOCIATIONS.—It takes a long while to evolve a workable scheme for the promotion of education and research to which the financial managers of all ceramic industries will subscribe. That the financial managers want the most productive means of education and research is shown by the admirable amount of effort and money they are spending for these through their respective trade associations. This society recognizes that this is not only an admirable activity for trade associations but also that the trade associations alone have the means and influence to organize and to finance research and educational schemes.

AMERICAN CERAMIC SOCIETY IN RESEARCH.—This society was not organized to finance nor to manage co-operative research. It is solely an opportunity of individuals to exchange information and to promote means for ceramic education and research. Our committees make surveys and give advisory assistance in organizing, and, when necessary, have accepted sponsorship. Co-operative researches by trade associations and collaboration of trade associations through group institutes have been advocated by this society but beyond the promotion of such organized efforts this society has not ventured.

FEDERATION OF ALL CERAMIC ASSOCIATIONS.—Unquestionably, this society has shown the possibility and advantage of all ceramic groups being in one organization for the purpose of education and research. Manufacturers of wares in which a silicate glass either constitutes the whole or is the vitrifying material have the same fundamental science facts to consider, collate, and apply. Their problems, even those of processing, overlap greatly. The technical men from the glass, clay, and glass enamel industries have for 28 years found it easy and profitable to have a society in common for the purpose of meeting and publishing.

PROPOSED AMERICAN CERAMIC INSTITUTE.—Similar in makeup as this society could be an American Ceramic Institute by and for all ceramic trade associations in common. Such an Institute would not duplicate the functions and activities of this society nor those of any of the group institutes. Our ambitions for the time being are to show the way to and the benefits from an American Ceramic Institute by and for the Trade Associations.

THE BUREAU ADVISORY COMMITTEE.—There has been organized by the Bureau of Standards a committee to advise with the Bureau on ceramic problems. This committee is in form and in constituents exactly that which we are advocating for an American Ceramic Institute. It differs from that which we have advocated in that it is not by and for the ceramic manufacturers. So far as it goes and such as it is this society heartily endorses this Advisory Committee, and the members and officers of this society are loyal in their assistance in making its labors worth while.

There is no disloyalty nor conflicting aims in our advocacy of a permanent organization of ceramic manufacturers not limited to call by the Bureau for meetings and not limited by the Bureau in its activities and not subject to interpretations of its determinations by the Bureau.

RETURN FOR TAXES PAID.—The Federal Bureau like our several state universities is maintained by taxes. The ceramic manufacturers can have their share of the federal and state appropriations and can influence the character of educational and research work done in these government institutions only by being organized to give voice and to make their voice heard. The information producing agencies in this country are not being supported and are not being directed to obtain what rightfully the ceramic manufacturers of this country could and should obtain in return for the taxes they pay.

SCHEME FOR FINANCING RESEARCHES.—The scheme proposed does not call for pooling of money to pay for co-operative researches. It would in no wise take from nor alter the present scheme of trade associations, singly or in groups, making contract with laboratories for the conducting of investigations. It would not lessen nor alter the schemes of group manufacturers organizing and financing their own laboratories for routine tests and for research. All of the present arrangements entered into by the trade groups with research laboratories would be contracted for as now, each ceramic group paying only for the work they authorize.

And there would be no financial obligation of one group for the investigations supported by any other group. The American Ceramic Institute, as we have thought it out, would not be for financing researches. The only financial obligation to each association would be a pro-rated share in the salary, office, and traveling expense of a chief research advisor.

FULL TIME CHIEF RESEARCH ADVISOR NEEDED.—Our scheme is based on the full-time employment of a chief research advisor and the appointment of a representative to his advisory staff by each supporting association. This research advisor and his staff would study problems proposed for investigation from the standpoint of (1) what is known, (2) its practicability, (3) to whom it would be of interest, (4) the research laboratories best equipped in personnel and facilities for its prosecution, and (5) its probable cost. Incidentally this advisory staff could make generally known what fundamental data are required and advise research fellows in the universities and federal bureaus regarding their need and the methods of obtaining these required fundamental data. With the problems thus analyzed and planned, the association or associations interested would be in position to determine how, where and to what extent they wish to finance their investigations.

CONTRACTS AND REPORTS.—Contracts for such investigations would be entered into by the trade associations interested with the research organization by whom the work is to be done. The reports of such investigations would be private or public, and would be published as the contracting parties would agree. The American Ceramic Institute which we have proposed would not be a party to such research contracts nor control publication of results. The only contact had by the Ceramic Institute with the investigations would be advisory through the chief research advisor and his staff. They would have no authority nor directional powers.

VALUE OF INSTITUTE.—An American Ceramic Research Institute would be a power in times of stress, and in the securing a just share for ceramics of the large amount of money appropriated by federal and state governments each year for research.

Such an organization would make available the known basic data and facts relating to the problems. They would prevent a great deal of the ill-conceived investigations now being made. They would correlate observations and thus make deductions from investigations more accurate and applicable to production processes.

POSSIBLE COMBINATION OF AMERICAN CERAMIC SOCIETY AND INSTITUTE.—The American Ceramic Society as now organized can not effectively use a full-time chairman of its research committee because he would not have the direct and full support of the ceramic business executives. It is necessary that the business executives through their respective trade associations shall have control of such a chief research advisor and of his cabinet in order that the advisor and his staff may have the fullest possible scope, influence and serviceability.

We shall not be contented until the object here set forth is accomplished and we suggest that if in the organizing of this American Ceramic Research Institute it should be deemed feasible to so reorganize this society as to make the two a unit for ceramic research and education, the ceramic business executives will find the members and officers of this society ready to co-operate. We need a full-time employed ceramic research advisor and he must have the direct sympathy and direction of the ceramic business executives through their respective trade associations.

NEED FOR MORE CO-ORDINATION.—Ceramic science, technology, and education have now reached that stage in development where there is need in this country for more co-ordination in investi-

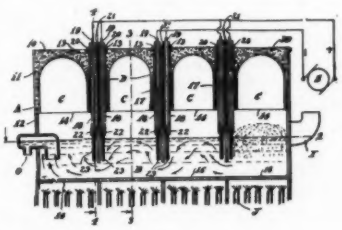
gations and a more rational planning and applying of information. As the amount of money invested in ceramic research and education increases there is an increasing need for employing means of obtaining co-ordination. Since this can be secured for an expenditure of not more than $10,000 per year and since this would free ceramic research of bureaucratic dictation to which the present Bureau Advisory Committee is subjected it would seem that the several ceramic trade associations should unite in organizing and supporting this proposed American Ceramic Research Institute. As secretary of this society I can not do more than to propose and the board of trustees of this society has done all it can in unanimously approving this proposal.

Recent Patents

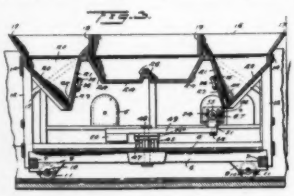
NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

ELECTROFINING GLASS FURNACE.. U. S. 1,594,496. Aug. 3, 1926, Walter G. Clark, of New York, N. Y. Filed 4/6/20. In the fining section of glass furnaces of the usual type the inventor arranges a plurality of electrical heat-introducing elements for adding further heat to the mass for the purpose of holding the said glass in said fining section or zones in a true molten state to permit the clearing out of all impurities, bubbles, etc. He claims: The combination in a furnace having a fining zone, of means for maintaining the glass in molten condition in the fining zone by heat other than electric, and means located within the molten mass of glass within the fining zone for introducing electric current through said glass, said last means being adjustable so as to vary the amount of electric current passing through said glass.

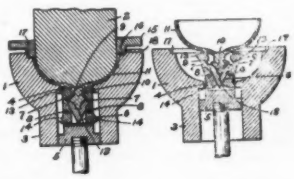


DEVICE FOR FEEDING MATERIALS INTO GLASS FURNACES. U. S. 1,593,756. July 27, 1926. John Debner, Blairsville, Pa. Filed 2/24/26. A portable carriage movable across the front walls of a battery of glass furnaces, a plurality of hoppers on the carriage, a ladle selectively positioned relative to the hoppers and movable through the furnace door openings, each hopper having a discharge opening at its lower end, a sliding gate valve for each opening, and independent means for operating each gate valve. Fig. 3 is a vertical longitudinal sectional view showing the separate hopper and the turntable construction for supporting the feeding ladle.



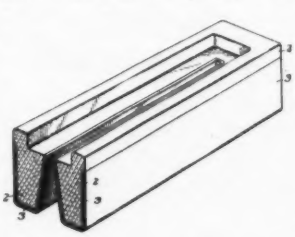
GLASS MACHINERY. U. S. 1,593,997. July 27, 1926. Clarence W. Avery and Wenzel G. Vesey, Detroit, Mich., assignors to Ford Motor Company. Filed 2/24/22. One object is to provide means in connection with the individual elements or units of a battery of grinding or polishing devices for insuring a uniform action upon the glass from each unit, so that the resulting action of the battery will be uniform, thereby producing continuously glass of uniform finish. This finish is accomplished by the rubbing of felt pads over the surface of the glass which has been coated with rouge. The rouge used for this process consists simply of iron oxide mixed with water and of a suitable consistency, the latter determining the effect of the polishing pads on the surface of the glass, that is, the amount and thickness or fluidity of the rouge controls the action of the pads on the surface of the glass assuming all other features, such as speed or the like, are equal. In this invention means are provided for increasing the supply of water to the rouge on the surface of the glass when the load on the unit driving mechanism becomes heavier, and means for cutting off the supply of water when the load on the unit driving mechanism becomes lighter, with the result that the increased supply of water thins the rouge thereby decreasing the proportionate action of the head on the glass, while cutting off the supply of water thickens the rouge proportionately thereby increasing the effect of the polishing head on the glass proportionately. By this means it is possible to maintain the load on each polishing head substantially uniform thereby securing glass of substantially uniform quality in substantially maximum amounts in proportion to the equipment used, and with a minimum amount of breakage.

PRESS MOLD FOR GLASS ARTICLES. U. S. 1,593,614. July 27, 1926. George E. Zeiler, Pittsburgh, Pa. Filed 4/6/22. A mold having an axial opening in the bottom thereof, the wall of said opening being inclined to form a cam surface, a plunger movably mounted in said opening, a plurality of levers pivotally mounted on said plunger and having complementary recesses formed therein adapted to co-operate with each other to form a divided mold adapted to form a necked-in projection on the molded article, said levers being further provided with cam surfaces adjacent to each end thereof adapted to engage the inclined wall of said opening to maintain said levers in operative molding position and to disengage them from the necked-in projection of the molded article to permit of the withdrawal thereof from the mold upon the completion of the molding operation.



METHOD OF ANNEALING AND COOLING SHEET GLASS. U. S. 1,595,912. Aug. 10, 1926. William L. Monro, Pittsburgh, Pa., assignor to Window Glass Machine Company, Pittsburgh, Pa. Filed 2/12/26. In the method of producing substantially flat sheet glass, the steps consisting in supplying flat hot glass to a horizontally extending lehr tunnel, supplying streams of heated gases to the tunnel above and below the glass level adjacent one end of the tunnel and permitting streams thereof to travel through the tunnel in contact with the glass, and adding heat to the lower stream in adjusted amounts sufficient to compensate for the difference in temperature and velocity of the lower stream as compared with the upper stream so as to prevent warping of the sheet and insure the production of substantially flat sheet glass, substantially as described.

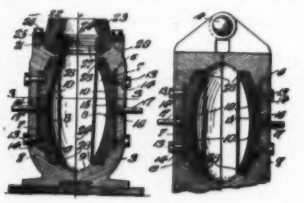
LINING FOR FURNACES AND THE LIKE. U. S. 1,593,566. July 27, 1926. Clarence P. Byrnes, of Sewickley, Pa. Filed 10/2/24. A furnace having a built-up wall formed of blocks, at least part of said blocks having a fused silica face portion adapted to contact with fused bath materials contained in said furnace. Such parts are provided with a fused surfacing material, such as fused quartz, which will resist the bath action under the temperatures imparted to the walls of the orifice, and maintain its smooth surface. Fused carbide of tungsten may also be used for this purpose. Also adapted for glass shaping elements, such as Fourcault drawing blocks, etc.



GLASS SHAPING OR FEEDING. U. S. 1,593,567. July 27, 1926. Clarence P. Byrnes, Sewickley, Pa. Filed 10/29/25. The main feature lies in providing a shaping or feeding surface formed of

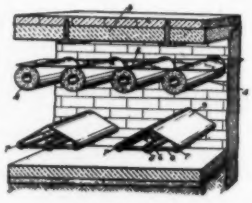
the material known as "fused silica" or fused quartz or of similar material. The material known as fused silica has a high melting point of about 1700° C. Experiments have shown that it will withstand the contact of molten or plastic glass, particularly if it is maintained below its devitrifying point. This devitrification does not ordinarily occur at temperatures below 1000° C, and is very slow up to 1200° C. The shaping surface is maintained at a temperature below that where material devitrification occurs, by the cooling effect of the air or by special cooling means applied either externally or internally to the fused quartz material.

GLASS MOLD. U. S. 1,595,773. Aug. 10, 1926. Edgar A. Gillinder, Philadelphia, Pa., assignor to Gillinder & Sons., Inc. Filed 5/1/26. A mold is provided in which any number of different styles of globes may be molded, by the mere change of certain die molding elements or members and having the bottom plate of the usual character, and a pair of hinged mold members mounted upon said bottom plate and adapted to be locked so as to form a closed mold; each of the hinged halves of said mold having a suitable inner circular recess or socket in the inner face thereof, adapted to receive corresponding embossed face die plates, means to align and secure said embossed face die plates in said recess or socket, the inner or molding surfaces of said die plates forming an uninterrupted continuation of the inner molding surfaces of said mold halves, and a pair of thread mold die members having suitable thread molding inner surfaces, detachably secured to the neck portion of the mold halves, so as to form a continuation of the body of the mold, and thereby to mold a threaded neck on the body of the globe.



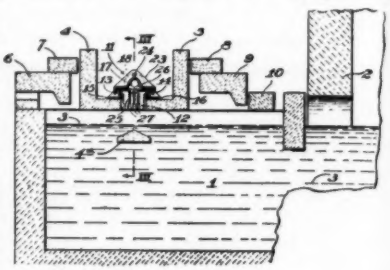
METHOD OF AND APPARATUS FOR ANNEALING AND COOLING SHEET GLASS. U. S. 1,593,627. July 27, 1926. Lawrence A. Gessner, Jeannette, Pa., Assignor to Window Glass Machine Co. Filed 11/3/23. In the method of making substantially flat sheet glass, the steps consisting in feeding sheet glass through a lehr, passing heated gaseous fluid through the lehr in the same direction as the travel of the glass, and maintaining a substantially smooth and continuous flow of gaseous fluid above and below the sheet in such relative and adjusted amounts as will substantially prevent warping or bowing of the glass in the lehr. This process and apparatus do not relate to sagging of the edge portions of the sheet between supports in its passage through the lehr due to the weight of the glass but to the prevention of warping or distorting of the glass due to strains set up in the glass itself.

LEHR FOR CONTINUOUS SHEET GLASS. U. S. 1,595,125. Aug. 10, 1926. James B. Small, Charleston, W. Va., assignor to Libbey-Owens Sheet Glass Co. Filed 7/14/24. Relates particularly to improvements in the lehr in which the glass sheet is annealed. Each burner is in the form of a gas pipe extending transversely across the lower portion of the lehr and provided with a longitudinal series of feed openings for the gas, and with a sheet metal shield supported above and extending somewhat to either side of the burner. The heat from the burner must either be radiated from this shield or must escape around the two sides of the shield, and in this way the heat will be diffused across a comparatively large area of the lehr chamber above the burner, and thus avoid the spotty heat conditions heretofore present.

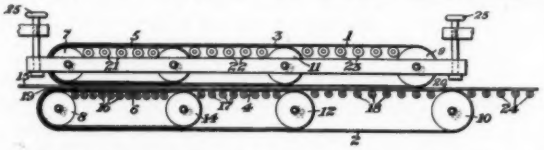


PROCESS OF MAKING GLASS [from blast furnace slag]. U. S. 1,595,358. Aug. 10, 1926. Charles E. Parsons, New York, assignor to Metal Research Corporation. Filed 9/19/25. By this process, it is proposed to produce colorless glass by obtaining the silica and lime from the relatively inexpensive blast furnace slag and to also employ sodium chloride in the charge, which is the cheapest form of solium compound, instead of the more expensive carbonate or sulphate of soda. The process provides a blast furnace with a charge consisting of a mixture of blast furnace slag and carbonaceous fuel; adding at the starting of the furnace to the first portions of the charge sodium carbonate or other suitable compound capable of producing a liquid slag; adding to the charge an alkali metal chloride, preferably sodium or potassium chloride; igniting the charge to produce a glass or slag; and continuing the production of said glass or slag until the desired quality of glass is had.

GLASS TANK CONSTRUCTION. U. S. 1,596,666. Aug. 17, 1926. Karl G. Kutchka, Wilkinsburg, Pa., assignor to Pittsburgh Plate Glass Co. The combination with a glass tank, of a refractory top member in opposition to the surface of the glass provided with a plurality of passages leading downward through said member, and means for supplying a mixture of gas and air through said passages.

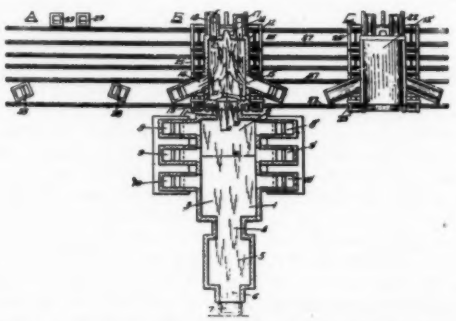


METHOD OF AND APPARATUS FOR TREATING MOLTEN MATERIALS. U. S. 1,595,103. Aug. 10, 1926. Charles B. Kingsley, Elizabeth, Pa., assignor to Mississippi Glass Co. Filed 3/21/24. In glass annealing apparatus, in combination, a lehr comprising a table comprising a set of endless belts of different lengths and of heat insulating material, said belts being arranged one about the other to form a table whose thickness varies along the length thereof, and another set of belts of heat insulating material similarly



arranged about each other and above and along said table to form a cover thereover varying similarly in thickness along its length, means for passing sheets of molten glass to said table, means for moving said belts synchronously with said sheet glass whereby the surfaces of said belts nearest the glass are caused to move in the same direction as said glass, whereby said sheet glass moves over and along with said table, said upper belts being wide enough for their edges to fall down around the edges of said sheet glass, and long enough to rest on and ride along with said sheet glass to act as closure means for the space between said table and roof.

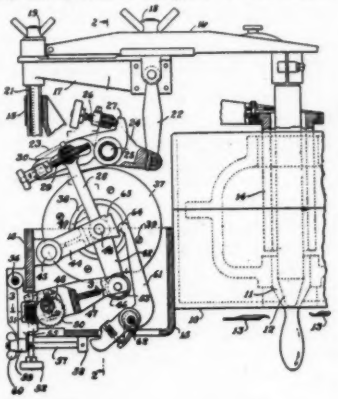
GLASS-MELTING FURNACE. U. S. 1,596,058. Aug. 17, 1926. Leopold Mambourg, Lancaster, O., assignor to Libbey-Owens Sheet Glass Company. Filed 2/7/23. Covers the method which consists in introducing molten glass into a refining tank, melting raw



materials in a tank disconnected from the refining tank and subsequently uniting said tanks and causing a union of the glass in the two tanks into a single pool. Also in a continuous tank furnace, a melting tank, a refining tank, and a neck or conduit connecting the two tanks, the melting tank being bodily movable away from operating connection with the refining tank.

APPARATUS FOR MAKING SHEET GLASS. U. S. 1,596,654. Aug. 17, 1926. Joseph S. Gregorius, Mount Vernon, O., assignor to Pittsburgh Plate Glass Company. Filed 1/13/20. In combination with apparatus arranged to draw a glass sheet from an open pool of molten glass, of means for preventing inward movement of the edge of the sheet in said pool comprising a shielding plate spaced above the surface of the pool but closely adjacent thereto and having a slot extending inward from its edge and fitting around the edge of the sheet, a cooling member mounted on the plate along each side of the slot, and means for circulating a cooling liquid through said members.

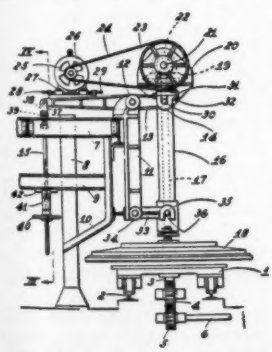
GLASS-FEEDING APPARATUS. U. S. 1,596,438. Aug. 17, 1926. Edward H. Lorenz, West Hartford, Conn., assignor to Hartford-Empire Company. Filed 11/18/26. Apparatus for feeding molten glass, comprising a container for the molten glass having a discharge outlet, a reciprocating implement for regulating the discharge of glass through the outlet, a cam and cam roll for reciprocating the implement, and means for adjusting the cam roll circumferentially with respect to said cam, whereby the time of operation of the implement may be changed.



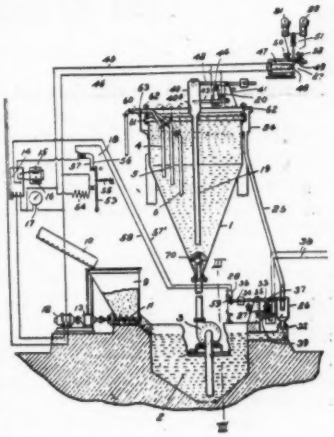
METHOD AND APPARATUS FOR FLATTENING GLASS. U. S. 1,596,749. Aug. 17, 1926. Samuel A. McKittrick, Sandusky, O. Filed 10/10/25. The method of flattening curved shawls of glass which comprises placing a shawl upon a flattening stone in a portion of a flattening furnace where the heat is sufficient to cause the glass to soften and flatten out on the stone, shifting said stone with the flattened glass sheet thereon to a point where the temperature is lower, and applying a cooling medium to the top surface of said sheet.

GLASS-FEEDING MECHANISM. U. S. 1,596,124. Aug. 17, 1926. Theodore C. Steimer, deceased, by Charles M. Steimer, executor, Zanesville, Ohio, assignor to The Hartford Special Machinery Company. Original application filed Feb, 12, 1910. This application filed Oct. 27, 1925. In an apparatus for delivering glass; the combination with a melting furnace pivoted to move on a horizontal axis, a heated chamber adjacent to the furnace and having a delivery orifice, and co-ordinated means to permit the intermittent flow of glass from the orifice and to tilt the furnace to deliver glass to the heated chamber at a rate equal to the rate of escape from the orifice to maintain a constant glass level in the chamber.

APPARATUS FOR SURFACING GLASS AND THE LIKE. U. S. 1,596,604. Aug. 17, 1926. Albert E. Evans, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company. Filed 6/5/26. In combination in a surfacing machine, a framework, a surfacing unit mounted and guided for vertical movement with respect to the framework and comprising a support provided with bearings, a vertical runner shaft journaled therein, and a runner secured to the lower end of the shaft, driving means mounted independent of said unit to one side thereof, counterbalancing means connected to the support, and driving connections between the driving means and said runner shaft, the said unit being releasably supported upon the framework so that it may be removed bodily therefrom.



APPARATUS FOR APPLYING ABRASIVE TO GRINDING APPARATUS. U. S. 1,596,658. Aug. 17, 1926. Halbert K. Hitchcock, Pittsburgh, Pa. Filed 1/22/24. In combination, apparatus for supplying abrasive to grinding mechanism comprising a grading tank arranged to discharge simultaneously to said mechanism from different levels in the tank, a pump for supplying a mixture of abrasive and water to the lower portion of the tank to provide a grading flow upward therethrough, and feed means controlled by the density of the mixture in the tank for supplying abrasive to said pump, said means including an upright tube in the tank, open at its lower end and having an enlargement at its upper end extending above the level of the water in the tank.

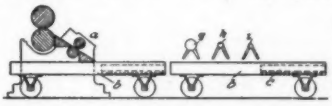


METHOD OF DEPOSITING SILVER. U. S. 1,593,998. July 27, 1926. Blasius Bart, East Orange, N. J. Filed 11/10/23. A method of coating articles such as glass reflectors with silver.

OIL-BURNER CONTROL. U. S. 1,596,836. Aug. 17, 1926. Joseph B. Hoff, Philadelphia, Pa. Filed 4/13/26. A safety oil burner control including a switch in the main circuit of a motor operating an oil burner.

PROCESS OF MAKING BIFOCAL LENSES. U. S. 1,596,714. Aug. 17, 1923. Lucian W. Bugbee, Indianapolis, Ind., assignor to Franklin Optical Co., Indianapolis, Ind.

METHOD AND PLANT FOR MANUFACTURING PLATE GLASS. U. S. 1,596,640. Aug. 17, 1926. Lambert von Reis, Herzogenrath, Germany. Filed 4/28/26. The method of manufacturing plate glass, which consists in rolling the glass plates on a rolling machine, carrying the rolled glass plates from the rolling machine to an annealing kiln, and while on their way to this kiln heating that part of the plates which has been rolled out first.



Industrial Publications

Kirk & Blum Blower Systems. A handsome 8½ by 11-inch 49-page catalog devoted to blower systems and discussing briefly the fundamental essentials, design and construction as applied by Kirk & Blum, engineers, to their cooling, ventilating and dust collecting systems. Various types of fans, blowers and air piping are illustrated and briefly described. Many typical installations in various industries including equipment at the Ford Motor Company's River Rouge glass factory and other Ford plants are illustrated and described and also an extensive installation at the Hemingray Glass Company, Muncie, Ind. Copies of the catalog may be obtained from the Kirk & Blum Manufacturing Company, Cincinnati, O.

Buffalo Electric Blowers. A four-page pamphlet describing Type FB variable and constant speed electric blowers which are made in seven sizes with capacities ranging above 4,000 cubic feet per minute. These blowers are especially adapted for individual use on oil or gas furnaces located some distance apart where they operate more economically than a large pressure fan as the loss from friction in long ducts is eliminated. **Baby Conoidal Fans.** Catalog No. 475. Built in sizes to operate from 78 cubic feet to 6,850 cubic feet per minute, these fans are used extensively for ventilation purposes, for supplying air to oil and gas burners and for cooling purposes. Both of these catalogs may be obtained from the Buffalo Forge Company, Buffalo, N. Y.

The Glass World and What It Is Doing

News of the Industry

Glass Container Association Expands Its Service

The meeting of the members of the Glass Container Association held at the Marlborough-Blenheim Hotel, Atlantic City, in July has been characterized as being perhaps the most resultful meeting ever held in the history of the Association. There was a good attendance, especially in view of the fact that but two months earlier many of the members had attended a large and successful meeting at Montreal.

Ever since the inception of the Glass Container Association movement, the work of this Association has been gradually expanding, until today, it contemplates in its program a list of vital services for its members which is equalled, if at all, by few American trade associations.

As authoritatively stated, as this program has been expanding the need for more money became evident and this meeting was called for the purpose of placing the needs of the Association before its membership and of arranging a method of contribution to the Association by the members that would be both equitable and produce enough funds for the developing work. This plan, which was initially suggested in the Montreal meeting, was carried out almost 100 per cent completely at Atlantic City.

The situation was well expressed by Thomas W. Rowe of the American Bottle Company, who made the following statement at the membership dinner, Friday evening. "This has been my first attendance at a meeting of the Glass Container Association and I must confess that on the first day, when I heard the amount of money that your Association was spending I felt that it was an extravagantly organized and administered movement, but every session of this meeting that I have attended since has convinced me that the work that is being done by your Association and the effort that is being put in the movement by your officers well deserves the liberal increase which has been provided for by your members."

On the Thursday morning, July 29, President Frank Ferguson presented to the members a "Review of the Situation in Our Industry." Judge I. G. Jennings, the Association's popular business manager, spoke on "General Announcements and Exposition of Group Meetings." In the afternoon "A Tariff Talk" was given by Aubrey L. Faubel, secretary of the American Protective Tariff League, and H. J. Armstrong, assistant treasurer of the Vacuum Oil Company, spoke on the subject of "What Must be Considered in Reaching Sound Credit Conclusions." The report of the statistical committee was presented by Fred J. Rummel.

On Friday morning, Warren Bishop, managing editor of *Nation's Business* spoke on "The Trade Association and the New Competition." "A Talk on Advertising" was given by James Morrison, of the Owens Bottle Company. Reports of S. H. Ayers, of the research department, and J. C. Magness, of the traffic department, were presented. Short talks and discussions by members followed.

Dinner at the Hotel Traymore at 7 P. M., with Frank Ferguson as toastmaster, was enjoyed. Thomas W. Rowe, of the American Bottle Company, Toledo, gave a talk on "My First Meeting with the Glass Container Association," and Francis H. Green spoke on "The Six Great Cities of the World." Talks were given by members and singing indulged in and an enjoyable evening was spent.

The talk given by Warren Bishop was particularly appropriate for the occasion. He pictured a new kind of commercial competition, one involving a struggle between competing materials instead of among the units of a single industry.

"Even now," said Mr. Bishop, "the new competition is appearing in the development and marketing of rival materials in many lines."

"If I am planning to build a house," he said, "the fight for roofing contract is not between two local dealers who sell shingles, but between industries which offer me not only shingles, but copper, slate and composition material of all kinds. In purchasing my hosiery I am approached by the manufacturers of woolen goods, cotton goods, silk and rayon. Whole industries are associating themselves together to push a particular material against the field."

The defense of an industry against competition, Mr. Bishop declared, is to be found in close co-operation within the industry, in operation through its trade association. No individual producer, he said, can stand against a competing industry, but the industry as a whole, through research can protect itself."

Heavy Increase in Footage of Plate Glass Imports

The monthly summary of United States glass and glassware imports and exports which appears on the last text page of each issue, is of particular interest this month because the table gives completed figures for the fiscal year ending June, 1926.

During this year, exports increased slightly from $8,383,381 for the year ending June 30, 1925, to $8,766,226. Imports increased from $17,387,390 in 1925 to $19,039,262.

There was a decrease of $237,495 in the value of glass containers (bottles, vials and jars) exported. An increase is shown in the exports of globes and shades for lighting fixtures to the amount of $107,356. Exports of other electrical glassware increased in 1926 by $170,566. Exports of miscellaneous glassware increased in 1926 approximately $300,000 in value.

The principal increase in imports were of glassware, cut or decorated, the gain amounting to approximately $400,000. There was also a gain in 1926 of approximately $220,000 in imports of bottles. Imports of chimneys, globes, shades, etc., in 1926 decreased approximately $100,000, but there was a gain of approximately $220,000 in chemical and scientific articles. Imports of miscellaneous glassware increased by approximately $400,000 in value.

Imports of cylinder, crown and sheet glass increased in value $500,872 and exports of window glass decreased about $25,000. Imports of plate glass, which amounted in twelve months ending June 30, 1926, to 16,795,213 square feet, valued at $7,877,590, increased in quantity to 22,191,954 square feet, the value of which, amounting to $7,745,863, was less than that of the smaller quantity imported during the previous year, the increase for the year in footage amounting to 5,396,741 square feet.

Photoglass Produced Mechanically in Belgium

According to a report from U. S. Consul William C. Burdett an interesting recent development in Belgium is the production of photoglass by mechanical means. Formerly all such glass was mouth-blown and it was generally accepted that mechanically drawn glass could not be used for this purpose. A factory at Jumet, Belgium, however, has already shipped 150 cases of photoglass which was produced by the Fourcault process of vertical drawing. Its quality is said to be good and prices are not higher than for mouth-blown glass. If this innovation proves successful it probably means the end of mouth-blown photograph glass production and will shorten the time until all hand-blown sheet glass factories in Belgium are superseded by the mechanical plants, except for small quantities of certain special glasses.

Mazda Lamp Prices Reduced

The General Electric Company on August 27 announced a further reduction in the prices of Mazda lamps, effective September 1, 1926, amounting to about 7 per cent on the sizes generally used of the new standard line of lamps and approximately 5% on all types.

This is the eighth reduction of Mazda lamp prices since 1920. This reduction, the company states, means a saving to the public of approximately $4,000,000 a year. The prices of these lamps are now 44% below the 1914 prices which compare with a 65% increase in the average cost of commodities since that year. The

reductions in prices have been made possible primarily by better manufacturing methods and by standardization and simplification of lamp types.

Weston G. Kimball—An Appreciation

By His Friend, R. R. Shuman of Chicago

On his 57th birthday anniversary, Weston G. Kimball, Western manager for the Pittsburgh Plate Glass Company, died suddenly at his home in Evanston, Ill., Thursday evening, July 29. He leaves a widow and a daughter Ruth.

He had made preparations to take the night train for St. Louis to attend the funeral of his friend, H. L. Brown, manager of the St. Louis branch of the company, on the following day, when he was seized with one of his recurrent heart attacks, and died within a half hour.

Brief funeral services were held at his home in Evanston, Saturday, by the Rev. Robert Holmes, Rector of Grace Episcopal Church, Chicago, followed by services at the chapel and at the grave at Rosehill Cemetery. The Chicago office and warehouse of the company were closed all day Saturday and the employees attended the funeral en masse. H. S. Wherrett, vice-president, from the Pittsburgh office, Ludington Patton, vice-president, Milwaukee, as well as the following warehouse managers also attended, to pay their last tribute to their friend: E. A. Schoenfelder, Milwaukee; R. W. McCabe, Davenport; R. M. Little, Des Moines; F. E. Dugan, Toledo; R. C. Adams, Indianapolis; F. W. Judson, Omaha; F. W. Currier, Minneapolis; J. J. Tanyan, Long Island City.

WESTON G. KIMBALL

The pall bearers were Weston Partridge, Wm. Campbell, Charles M. Pfister, M. E. Kind and Arthur B. Crosby of Chicago; besides Messrs. Adams, Dugan and McCabe named above.

Mr. Kimball was born at Waukegan, Ill., July 29, 1869, moving to Chicago with his parents some six years later. Though preparing for college at the Harvard School in Chicago, his health did not permit him to pursue his education further. At the age of seventeen he entered the employ of his father's firm, the George F. Kimball Co., Chicago's pioneer glass jobbing concern. When this firm was purchased by the Pittsburgh Plate Glass Co. in 1896, Mr. Kimball, Senior, remained as manager and his son as assistant manager. On his father's death, in 1901, Weston became manager of the Chicago branch. Though he was at that time the youngest branch manager of the company, his talent for organization and his natural executive ability soon made itself felt, and Chicago branch rapidly forged ahead into its present commanding position.

In 1917 he became Western manager, which position he held at the time of his death, having general supervision of the company's warehouses at Chicago, Milwaukee, Davenport, Des Moines, Toledo and Indianapolis.

Weston Kimball was a power for good in the glass industry, not only in the west, but nationally. His counsel was sought, not alone by his superiors and associates in his own company, but by competitors. "If Kimball says it, it's so" has been a familiar expression in the trade for years.

In Chicago he was looked upon as the life of the Western Glass Jobbers Association, especially at its meetings; for no matter what problems arose, he seemed to have a happy solution ready. As a harmonizer, among competitors in the industry, and between the industry and the labor interests his constructive work has had incalculable value. Said a member of the Association: "His cards were always on the table face-up. He had never anything up his sleeve. His only finesse was the finesse of frankness, backed by full and accurate information. I don't see how we can get along without him."

A prominent labor leader who attended the funeral said, "Mr. Kimball was the master-mind of the glass business. He was a hard fighter, but always fought fair."

In his relations with his competitors, with labor leaders, and with the managers and employees of the warehouses under his charge, a kindly spirit of fellowship and an inexhaustible fund of good humor coupled with absolute fairness, characterized all his acts.

He was a member of the Executive Committee of the Building Construction Employers Association of Chicago; a member, for years, of the Builders and Traders Exchange, which later made him an honorary member; and also a member of the Chicago Real Estate Board, Architects Club, Chicago Club, Mid Day Club, Lake Shore Athletic Club, and the Glenview Golf Club. His out-of-town affiliations included the Milwaukee Club, Des Moines Club, Toledo Club and Indianapolis Athletic Club.

Clinchfield Products Corporation Changes Hands

The Clinchfield Products Corporation, of New York and Erwin, Tenn., was purchased recently by Herbert P. Margerum, of Trenton, N. J. The Clinchfield Corporation was the first to enter the Southern field in 1912, for the purpose of preparing North Carolina spar for the market.

About three years ago, Mr. Margerum decided to enter the feldspar business and purchased the holdings of the Golding Sons' Company, which has been supplying dependable ceramic materials for the past sixty years. This company has developed a very substantial business and has provided itself with extensive feldspar mines in Maine, Connecticut, Maryland and North Carolina, with modern grinding mills at Trenton, N. J., East Liverpool, Ohio, and Erwin, Tenn. They also have large clay mines and plants at Hockessin, Delaware, and Butler, Ga.

During the latter part of 1925, a thorough investigation of the holdings of the Erwin Feldspar Company was made by Mr. Margerum, which he later took over and combined with the Golding Sons' Company, thus adding a number of important properties to his holdings. This combination has proven of much value to the users of feldspar inasmuch as it has permitted the establishment of greater facilities for rendering service.

Some weeks ago, Mr. Margerum was approached with a proposal to take over the Clinchfield Products Corporation and to combine their holdings with his other companies, which was done early in July of this year. It is his belief that he has provided a service for the ceramic industry that has not heretofore been available.

The New York office of the Clinchfield Company, at 350 Madison Avenue, will be maintained for a short period of time and will later be moved to the Trenton Trust Building, in Trenton, N. J., the headquarters of the Golding Sons' Company and Erwin Feldspar Company.

The organization's laboratory facilities are now being extensively increased and will be at the disposal of the various concerns using feldspar, clays, flints and Cornwall stone.

Owens Bottle Co. Reported Using Lynch Machines

The Owens Bottle Company, it is reported, have for several months been using a Lynch blowing machine in conjunction with their own machines at their Charleston, West Virginia, works and it is said have completely equipped their Huntington plant with Lynch machines and the latest Hartford-Empire automatic lehrs. The machines are said to be used only on special jobs.

Arbitration Saving Money

Twenty dollars was the average cost of settlements by arbitration during the first three months of existence of the American Arbitration Association, according to a report of its activities made public by Lucius R. Eastman, its chairman. During that period under the auspices of the Association, 53 hearings were held on matters of arbitration, 41 awards were made and 55 matters were amicably settled without resort to the arbitral machinery.

All of the arbitrators served without compensation.

Glass Companies Earnings for Second Quarter

The Owens Bottle Company, Toledo, O., has announced that for the three months ended June 30, manufacturing profits and royalties amounted to $3,118,059, and miscellaneous and other income, $131,716, making a total income of $3,249,776. After deducting $1,017,636 for miscellaneous and federal income taxes the net profit for the three months amounted to $2,232,139. Total earnings for the first six months of $3,446,552 were an increase of $733,280 over the same period of 1925.

The report of the Standard Plate Glass Company for the second quarter ended June 30, shows a net profit of $126,433 after all deductions were made, as compared with $27,601 for the first quarter of 1926 or an increase of $108,832. The total profit for the first six months of 1926 was $154,034 as compared with $326,151 for the same period of 1925.

The Hazel-Atlas Glass Company, Wheeling, W. Va., reports for the quarter ended June 26 a gross income of $1,240,895 as compared with $810,932 for the same period of 1925, a gain of 53 per cent. After deducting $573,933 for taxes, depreciation, interest, etc., the net profit for the second quarter amounted to $666,962.

Trade Activities

The Sunflower Glass Company, Sapulpa, Okla., is reported to be changing its plant to operate with machines.

American Window Glass Machine Company preferred and common stock was admitted to trading on the New York Curb Market on August 6.

Fort Smith Co-operative Window Glass Company, Fort Smith, Ark., has been incorporated with a capital of $75,000 by Edgar Berry and W. C. Cline.

The Superfos Company, dealers in and importers of glassmakers' chemicals, have moved their office from 25 Spruce street, to 535 Pearl street, New York.

The Ohio Valley Glass Company, recently organized, is erecting a factory building at New Martinsville, W. Va., for the manufacture of convex show case and clock glasses.

It is reported that the **Illinois-Pacific Glass Company,** 15th and Folsom streets, San Francisco, Cal., has awarded a contract for the construction of a new six-story building, 195 x 256 feet.

The Joliet Plate & Window Glass Company, 642 Cass street, Joliet, Ill., has been incorporated to sell and deal in glassware, glass ornaments, etc. The incorporators are: George F. Hacker, John Sime and Henry C. Ahrens.

The real estate and equipment of the old **Bellaire Bottle Company,** Bellaire, O., which was established about forty-five year ago, has been sold to J. A. DuBois, Sr., who also represents other interests. The making of bottles at this plant was discontinued in 1922.

The Libbey-Owens Sheet Glass Company, Toledo, O., on August 5 announced that quarterly dividends of 1¾ per cent on the outstanding preferred stock of the company and fifty (50) cents per share on the outstanding common stock were payable September 1, 1926, to stockholders of record at 3 p. m. on August 31, 1926.

The Queen City Glass Company. A report from Cumberland, Md., states that the Western Maryland Railway has donated a site on which the company will erect a new factory to replace the one recently destroyed by fire. The company was incorporated only a short time ago to manufacture pressed and blown ware.

National Plate Glass Company of Ottawa, Ill., according to reports from that city, are increasing their furnace capacity in order to make it equal to the capacity of the casting, grinding and polishing departments. It is said that the additional melting capacity will enable the company to reach the top limit of production.

The Adamston Flat Glass Company, Clarksburg, W. Va., formerly the Clarksburg Glass Company, manufacturers of flat drawn sheet glass, announced through W. M. B. Sine, president and general manager, that manufacturing operations started on August 14th and that the company is now operating to capacity. A. J. Bastin is factory superintendent.

The Tygart Valley Glass Company, Grafton, W. Va., whose plant was destroyed by fire last April, have, according to a statement made by the executive committee which had charge of raising funds for the reconstruction of the plant, announced through W. S. Stewart, president, and O. C. Noble, vice-president and general manager, that the factory will not be rebuilt.

The Eastern Plate & Window Glass Company, which was recently organized, has taken over the bottle plant formerly operated by Parker Bros. Glass Manufacturing Company at Bridgeton, N. J., and is installing new equipment, including a window glass tank for eight blowers. W. S. Phillips, formerly with the Brownsville Window Glass Company, is interested in the new venture.

The Southern Sash, Door and Mill Work Association at a recent meeting in Savannah, Ga., decided to give official sanction to the custom of using grade 'B" window glass as the standard for glazing when filling contracts where no other grade is specified. A movement is under way to change grade "A" to "extra glazing quality" and grade "B" to "standard glazing quality," and to eliminate grade "AA."

E. W. Koering of the Koering Glass Company, N. E. Boulevard, Vineland, N. J., has put on the market a new bent glass towel bar which is meeting with an excellent reception. The bar instead of being in straight lengths with the ends inserted in metal posts has both ends bent at right angles and fastened securely into short nickel-plated posts by means of a special clamp. Patents have been applied for on this and other features. C. E. Arnaud, 29 Broadway, is New York representative for this product.

The Hartford-Empire Company, Hartford, Conn., has awarded a general contract for the construction of a 3-story addition 53 x 90 feet to their glass machinery manufacturing plant. The building, including sprinklers, heating, plumbing, electrical work and two freight elevators with overhead trolley system, will cost approximately $65,000. They are also building a railroad siding which will cost an additional $7,000. The first two floors of this new building will be devoted to storage of rough and finished parts and to handling shipments, and the third story will be devoted exclusively to offices.

The Corydon Glass Company, Inc., works at Corydon, Ind., were destroyed by fire on August 6, 1926. The fire followed an electrical storm of severe proportions. The building was struck by lightning and the contents of the plant completely destroyed. This company was incorporated in April, this year, to manufacture table ware, and had just installed some valuable machinery. The plant will not be rebuilt as the company at Corydon is in the hands of receivers. The stock and machinery were partially insured. The officers of the company are Roscoe Atwood, president; Arthur B. Richart, secretary and treasurer. Mr. Richart is also cashier of the Old Capital Bank and Trust Company of Corydon, and Mr. Atwood is president of the Co-operative Enterprise Glass Company of the same place.

What Our Advertisers Are Doing

The Chapman Engineering Company, Mt. Vernon, O., will install nine Chapman floating agitators in the Pittsburgh Plate Glass Company's plant at Kokomo, Ind. This contract, when finished, will complete a total of nineteen agitators installed at this plant.

A contract has been awarded and construction begun by the **Austin Company** of Cleveland, O., on a $6,000,000 automobile plant, one of the largest industrial building contracts let this year, for the Oakland Motor Car Company's new plant at Pontiac, Mich. A previous contract to the amount of $150,000 covering engineering service had been given to the Austin Company in June. The new plant will contain 500,000 square feet of window glass.

The Wellman-Seaver-Morgan Company, Cleveland, O., announce that during the first eight months of this year they have sold fifty-six 10-foot W-S-M type "L" full mechanically operated gas producers, and two 8-foot producers of the same type. One of the 10-foot producers went to each of the Mississippi Glass Company, Port Allegany, Pa., and the Hemingray Glass Company, Muncie, Ind. An 8-foot producer was installed at the Hygeia Glass Company, Lancaster, N. Y. A number of installations were made for some of the very large steel manufacturers, such as sixteen at the Bethlehem Steel Company, Lackawanna, N. Y., seven in their Sparrows Point, Md., plant and six in their Steelton, Pa., plant. Eighteen were put in for the Colorado Fuel & Iron Company, Minnequa, Col. The sales make a total of 210 units placed in this country and abroad since the W-S-M type "L" producer was put on the market early in 1923. Previous to this time the Wellman-Seaver-Morgan Company manufactured the well-known Hughes type of gas producer, of which 1,100 machines were placed in operation over a period of seventeen years. The company states that the new type "L" has proved to be an improvement over the Hughes producer formerly manufactured.

Personals

F. F. Shetterly, who has been with the Corning Glass Works at its main plant at Corning, N. Y., was recently transferred to the company's plant at Kingsport, Tenn.

John Willis, active for years in the American Plate Glass Corporation, Kane, Pa., has resigned as assistant secretary and treasurer. According to local reports, however, Mr. Willis will continue to act in an advisory capacity.

Recent Deaths

Harold L. Brown

Harold Leavitt Brown, district manager at St. Louis for the Pittsburgh Plate Glass Company, died on July 28 from the effects of an operation. Mr. Brown was 51 years of age and had been connected with the company since 1903, starting at the Milwaukee warehouse. He was transferred in 1907 to take charge of the St. Louis branch. He was a brother of Captain Charles W. Brown, president of the company and also leaves, besides his wife and a son, another brother, J. F. Brown, of Boston, Mass., and two sisters.

Coming Meetings

AMERICAN CERAMIC SOCIETY summer meeting will be held August 30 to September 2 at Bellevue-Stratford Hotel, Philadelphia, Pa., during Ceramic Week of the Sesqui-Centennial Exposition.

THE EASTERN DIVISION OF THE NATIONAL GLASS DISTRIBUTORS' ASSOCIATION will hold its fall meeting at the Hotel Traymore, Atlantic City, N. J., September 28, 29 and 30.

THE AMERICAN BOTTLERS OF CARBONATED BEVERAGES will hold its eighth annual convention and exposition at Buffalo, N. Y., November 8 to 12, 1926.

THE AMERICAN CHEMICAL SOCIETY. Fiftieth anniversary, Golden Jubilee, Philadelphia, September 6 to 11. Three thousand chemists from all parts of the world are expected. Gas and fuel chemistry and industrial and engineering chemistry are among the subjects that will be discussed.

THE SIXTH CONGRESS OF INDUSTRIAL CHEMISTRY will be held in Brussels, Belgium, from September 26 to October 3, 1926.

MIRRORS MANUFACTURERS' ASSOCIATION will hold their next meeting at Atlantic City, September 28.

Inquiries Received

For Further Information Address GLASS INDUSTRY.

342. Can you give us the addresses of manufacturers of hand cups, or vacuum cups, used by workmen for handling plate glass during manufacturing operations? (Aug. 18)

343. We would like to have the names of manufacturers of auto lenses and optical glass. (Aug. 11)

344. Who makes machinery used in making moldings of opaque glass?

What the World Wants

Specific Inquiries for American Goods Received in the Department of Commerce

Sweden. 21498, glass (hand mirrors).
India. 21571, window glass.
Singapore. 21563, variegated and flowered glassware.
South Africa. 21695, glassware.
Portugal, 21907, glass for automobile lamps.
India. 21857, glass sheets and plate for windows and windshields.

Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE AUGUST 21, 1926

Reported by Moore, Leonard & Lynch, Union Trust Building, Pittsburgh, Pa.

	Bid	Ask	Last
American Window Glass Machine, com.	63	64	63
American Window Glass Machine, pfd.	84	85	84
American Window Glass, pfd.	109½	110	109½
United States Glass	16½	17	16
Pittsburgh Plate Glass, com.	290	295	290
Standard Plate Glass, com.	6¼	6½	6¾
Standard Plate Glass:			
Preferred cumulative	30	32½	32½
Prior preferred	85¼	86	85¼

WHEELING STOCK EXCHANGE, AUGUST 25, 1926.

	Bid	Ask	Last
Hazel Atlas	...	...	49
Imperial	...	...	72
Fostoria	...	...	150
Central	...	...	75

TOLEDO STOCK EXCHANGE, AUGUST 24, 1926.

	Bid	Ask	Last
Onews Bottle Machine, com.	...	...	...
Libbey-Owens Sheet Glass, com.	...	...	128
Libbey-Owens Sheet Glass, pfd.	...	...	116

READERS WANTS AND OFFERS

Situations Open

GLASS ENGRAVER

WANTED: Man experienced on Chemical and Laboratory Glassware Engraving, and capable of directing department. Give full details in reply. Address: ENGRAVER, care GLASS INDUSTRY, 50 Church St., New York.

PLATE GLASS FINISHER AND CASTER

WANTED: A man experienced in finishing and casting plate glass, who thoroughly understands the work. State age, experience, wages expected and references. Address, CASTER, care GLASS INDUSTRY, 50 Church street, New York.

Situations Wanted

GLASS MAKER AND MANAGER

WANTS POSITION. Is experienced with tank and pot furnaces, and factory direction. Has formulæ, and has made tubing, bottle shells, and laboratory apparatus ware. Age 42, and married. Address: GLASSMAKER, care GLASS INDUSTRY, 50 Church St., New York.

GLASS CHEMIST

WANTED: Position in plant or laboratory. Extensive training as an analyst with thorough experience on tank operation, lehr management, batch control and pyrometer equipment installation. American, University Graduate. Age 27. Address, GLASS CHEMIST, care GLASS INDUSTRY, 50 Church St., New York.

Current Prices of Glass-Making Materials

August 24, 1926

Quotations furnished by various producers, manufacturers and dealers

		Carlots	Less Carlots
Acid:			
Citric	lb.	.44½	.44½
Hydrochloric (HCl) 20° tanks, per 100 lb.	lb.	.95-1.05	..
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	..	.11-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.	lb.	5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.00-16.00	..
Tartaric	lb.	.29	.29½
Alcohol, denatured	gal.	..	.37½
Aluminum hydrate ($Al(OH)_3$)	lb.	.05	.05½
Aluminum oxide (Al_2O_3)	lb.	..	.05
Ammonium bifluoride (NH_4) FHF	lb.	..	.23-.23¾
Ammonia water (NH_4OH) 26° drums	lb.	..	.03½
Antimony, metallic (Sb)	lb.	..	.16
Antimony oxide (Sb_2O_3)	lb.	..	.16½
Antimony sulphide (Sb_2S_3)	lb.	.15	.16½
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.03½	.04
Barium carbonate ($BaCO_3$)			
Precipitated	ton	51.00-55.00	51.00-58.00
Natural, powdered, imported	ton	42.00-44.00	45.00-46.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	.43-44
Barium nitrate ($Ba(NO_3)_2$)	lb.	.07½	.07¾
Barium selenite ($BaSeO_3$)	lb.	..	..
Bone ash	lb.	.05	.05½
Borax ($Na_2B_4O_7.10H_2O$)	lb.	.04¾	.05-.05½
Boric acid (H_3BO_3)	lb.	.09	.09¾
Refined	lb.	.08½-.09	.09-.09½
Cadmium sulphide (CdS)—			
Red	lb.	..	1.20
Orange	lb.	..	1.05-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.28	.29-.31
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.20
In 10 lb. tins	lb.	..	2.10
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.25-.28
Black prepared	lb.	..	.30
Cryolite (Na_3AlF_6) Natural Greenland Kryolith)	lb.	..	.09½-.09½
Artificial or Chemical	lb.	..	.09
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		1.20	1.35
Feldspar—			
100 mesh	ton	11.00-20.00	16.00-22.00
80 mesh	ton	13.50	..
40 mesh	ton	..	..
Fluorspar (CaF_2)—			
Powdered white, 95%	ton	40.00	40.00
" " 90%	ton	38.00	..
Formaldehyde	lb.	.10¼	.10¾
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.02-.03
Black (FeO)	lb.	..	..
Kaolin (f.o.b. mine)	ton	10.00	..
English, lump, f.o.b. New York	ton	13.00-23.00	..
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb	.12	.12¼
Litharge (PbO)	lb.	.11½	.11¾
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	12.50	..
Burnt (CaO) ground, in bulk	ton	9.00	..
Burnt, ground, in paper sacks	ton	11.00	..
Burnt, ground, in 280 lb. bbls. Per bbl.		2.15	2.30
Limestone ($CaCO_3$)	lb.	..	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.04	.04½
light (in bbls.)	lb.	.22	.24
extra light (in bbls.)	lb.	..	.32-.37
Magnesium carbonate ($MgCO_3$)	lb.	.06¼	.06¾
Manganese 85% (MnO_2)	lb.	.04¾	.05
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	19.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08¼	.08½
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06½	.06¾
Hydrated 80-85%	lb.	.05¾	.06
Potassium chromate (K_2CrO_4)	lb.	..	.27
Potassium hydrate (KOH) (caustic potash)	lb.	.07⅛	.07⅝
Potassium nitrate (KNO_3) (gran.)	lb.	.05⅞-.06	.06⅛-.06¼
Potassium permanganate ($KMnO_4$)	lb.	.14½	.15
Powdered blue	lb.	..	.24-.26
Rochelle salts, bbls.	lb.	..	.20
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.26	.25
Salt cake, glassmakers (Na_2SO_4)	ton	20.00-22.00	25.00-35.00
Selenium (Se)	lb.	..	2.10-2.15
Silver nitrate ($AgNO_3$)	oz.	..	.44½
Soda ash (Na_2CO_3) dense, 58%—			
Bulk Flat per 100 lb.		1.35-1.40	..
Bulk, on contract Flat per 100 lb.		1.35	..
In barrels Per 100 lb.		1.69	2.40
In bags Per 100 lb.		1.45	..
Spot orders .05 per 100 lbs higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06⅜	.06⅝
Sodium hydrate (NaOH) (caustic soda) Per 100 lb.		3.60	4.16
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04⅛
95 per cent. Per 100 lb.		2.34	2.75
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.04¾	.05
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.10-1.30
Sulphur (S)—			
Flowers, in bbls. Per 100 lb.		3.45	3.75-4.00
Flowers, in bags Per 100 lb.		3.10	3.40-3.65
Flour, heavy, in bbls. Per 100 lb.		2.75	3.05-3.30
Tin chloride ($SnCl_2$)) (crystals)	lb.	..	.45
Tin oxide (SnO_2) in bbls.	lb.	..	.66
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots	lb.	..	1.20-1.90
Zinc oxide (ZnO)	lb.	.07½	.07¾

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to July 24, 1926

	June 1925 Quantity	June 1925 Value	June 1926 Quantity	June 1926 Value	Twelve Months Ending June 1925 Quantity	Twelve Months Ending June 1925 Value	Twelve Months Ending June 1926 Quantity	Twelve Months Ending June 1926 Value
Glass and glass products (total)	.....	$694,354	.....	$772,641	.....	$8,383,381	.....	$8,766,226
Plate and window glass—								
Window glass, common, box 50 sq. ft.	3,206	18,227	1,380	9,213	34,465	179,559	28,139	154,576
Plate glass, unsilvered, sq. ft.	114,287	41,228	89,893	23,650	1,536,734	427,909	1,515,843	368,973
Other window and plate glass lbs.	286,406	30,016	268,860	22,500	2,161,346	226,438	2,548,087	268,593
Glass containers (bottles, vials and jars)	.....	264,723	.....	257,728	.....	3,006,011	.....	2,768,516
Table glassware, plain	.....	116,448	.....	144,644	.....	1,736,390	.....	1,731,128
Table and other glassware, cut or engraved	.....	12,805	.....	13,280	.....	171,840	.....	183,737
Lamp chimneys and lantern globes lbs.	164,147	28,803	180,082	32,992	1,962,840	341,217	2,035,670	400,486
Globes and shades for lighting fixtures lbs.	129,610	39,199	161,253	48,413	1,484,587	433,006	1,773,678	540,362
Chemical glassware lbs.	15,962	13,658	14,319	14,176	247,474	194,094	225 892	210,801
Electrical glassware, except for lighting lbs.	156,590	15,870	831,526	60,063	2,545,475	240,017	4,218,994	410,683
Other glassware	.....	113,377	.....	145,982	.....	1,426,900	.....	1,728,371

IMPORTS

Corrected to July 24, 1926

Glass and glass products (total)	.....	1,542,651	.....	1,854,233	.....	17,387,390	.....	19,039,262
Cylinder, crown and sheet—								
Unpolished dut. lbs.	3,496,799	188,020	8,695,232	329,507	41,503,325	2,235,836	59,066,978	2,736,709
Bent, ground, beveled, colored, painted, etc., and polished dut.	.....	48,401	.....	45,162	.....	535,600	.....	534,769
Plate glass dut. sq. ft.	1,818,684	816,357	2,206,955	762,575	16,795,213	7,877,590	22,191,954	7,745,863
Containers—bottles, vials, etc dut.	.....	10,004	.....	30,037	.....	169,398	.....	245,984
Table and kitchen utensils dut.	.....	16,014	.....	6,355	.....	147,172	.....	136,306
Glassware, cut or decorated dut.	.....	177,801	.....	242,561	.....	2,121,261	.....	2,624,271
Blown glassware, n.e.s.—								
Bottles, ornaments, etc dut.	.....	89,597	.....	175,250	.....	1,641,048	.....	1,864,946
Bulbs for electric lamps dut. No.	1,576,880	17,195	1,579,119	17,264	19,266,546	211,532	16,366,814	186,695
Chimneys, globes, shades, etc dut.	.....	70,779	.....	88,699	.....	1,126,860	.....	1,022,755
Articles and utensils for chemical, scientific and experimental purposes dut.	.....	31,549	.....	57,318	.....	314,823	.....	531,015
Other glassware dut.	.....	76,934	.....	99,505	.....	1,006,270	.....	1,409,949